December, 1948

EDISON ELECTRIC INSTITUTE BULLETIN

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ELECTRICAL RESEARCH STATISTICS
THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

September, 1947-1948

SOURCE AND DISPOSAL OF ENERGY—MONTH OF SEPTEMBER

	1948	1947	%
GENERATION* (Net)			
By Fuel Burning Plants	17,594,783,000	15,874,740,000	+10.8
By Water Power Plants	6,039,727,000	5,606,145,000	+ 7.7
Total Generation	**23,634,510,000**	**21,480,885,000**	**+10.0**
Add—Net Imports Over International Boundaries	73,000,000	93,435,000	−21.9
Less—Company Use	110,144,000	120,775,000	− 8.8
Less—Energy Used by Producer	381,827,000	378,258,000	+ 0.9
Net Energy for Distribution	**23,215,539,000**	**21,075,287,000**	**+10.2**
Losses and Unaccounted for	2,676,332,000	2,579,591,000	+ 3.8
Sales to Ultimate Customers	**20,539,207,000**	**18,495,696,000**	**+11.0**

CLASSIFICATION OF SALES

NUMBER OF CUSTOMERS—As of September 30th			
Residential or Domestic	33,044,035	31,155,849	+ 6.1
Rural (Distinct Rural Rates)	1,664,079	1,477,931	+12.6
Commercial or Industrial:			
Small Light and Power	5,113,654	4,917,665	+ 4.0
Large Light and Power	206,562	189,260	+ 9.1
Other Customers	139,471	132,552	+ 5.2
Total Ultimate Customers	**40,167,801**	**37,873,257**	**+ 6.1**
KILOWATTHOUR SALES—During Month of September			
Residential or Domestic	4,017,625,000	3,511,847,000	+14.4
Rural (Distinct Rural Rates)	733,325,000	607,337,000	+20.7
Commercial or Industrial:			
Small Light and Power	3,804,696,000	3,406,374,000	+11.7
Large Light and Power	10,720,926,000	9,724,471,000	+10.2
Street and Highway Lighting	206,004,000	192,572,000	+ 7.0
Other Public Authorities	514,645,000	490,200,000	+ 5.0
Railways and Railroads:			
Street and Interurban Railways	297,478,000	318,596,000	− 6.6
Electrified Steam Railroads	194,512,000	198,955,000	− 2.2
Interdepartmental	49,996,000	45,344,000	+10.3
Total to Ultimate Customers	**20,539,207,000**	**18,495,696,000**	**+11.0**
Revenue from Ultimate Customers	**$366,155,300**	**$325,639,000**	**+12.4**

RESIDENTIAL OR DOMESTIC SERVICE

AVERAGE CUSTOMER DATA—For 12 months ended September 30th			
Kilowatthours per Customer	1,529	1,409	+ 8.5
Average Annual Bill	$46.18	$43.82	+ 5.4
Revenue per Kilowatthour	3.02¢	3.11¢	− 2.9

(*) By courtesy of the Federal Power Commission.

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Volume 16 DECEMBER, 1948 No. 12

The Electric Industry in 1948

Heavy Demand Continues Throughout Year: Capacity Installations, New Customers and Electric Production Set New Records; Reversal of Rate Trend Under Way

By Ernest R. Acker
President, Edison Electric Institute

IN a year of continuing heavy demand for electricity, the electric industry in 1948 installed an unprecedented amount of new generating capacity, topped the record set in 1947 for the addition of new customers, and made substantial gains in electricity production over the peak attained in the previous year. At the same time, rate adjustments during the year slowed the industry's 65-year downward movement of rates, and indicated a reversal of the trend in 1949.

More than 4,000,000 kw of new generating capacity were installed and operating by the end of 1948, as the electric industry's expansion program gained increased momentum. The added capacity represented the largest single year's increase in industry history, and brought the total generating capacity in service at the end of 1948 to over 56 million kw, compared with 52 million at the end of 1947.

Two Million Customers Added

Electricity production by all the nation's generating sources totaled about 336 billion kwhr in 1948, surpassing 1947's record production of 307 billion kwhr by 29 billion, an increase over that year of about 9 per cent. About 282 billion kwhr of the grand total were generated by the electric industry, while the remaining 54 billion were produced by industrial and railway plants for their own use. Generation by the electric industry showed a 10 per cent increase over 1947 production, about 26 billion kwhr higher than the 1947 total.

With more than 2 million new customers coming on electric lines, 1948 topped by a slight margin 1947's record of new customers added annually. The industry now has approximately 40,800,000 customers, about 7 million of whom have been added since V-J Day.

These gains in electrical service were distributed throughout the nation in varying proportions, with some areas showing greater than average growth as a reflection of industry and population shifts accelerated by the industrial development of some regions during the war.

Household Use Sets New High

With 94 per cent of all dwellings in the U. S. now taking electric service, and electric service available to an additional 3 per cent, average annual residential consumption of electricity, reflecting the availability of electric appliances, increased 112 kwhr per customer in 1948, the largest single year's increase yet recorded. This rise was greater than the total increase of the 6 years immediately following World War I, and brought the average annual residential electricity consumption to a new high of 1550 kwhr per customer. Ten years ago, in 1938, the average was 853 kwhr. In 1928, average annual residential use per customer was 463 kwhr, while in 1918 it was only 272 kwhr.

Electricity Available to 87 Per Cent of Farms

About 75 per cent of the nation's farms are now being supplied with electricity, and average annual farm use has risen to about 1900 kwhr per customer. An additional 12 per cent of the farms in the U. S. were estimated to be within one-quarter mile of power lines but not yet taking service. About 87 per cent of the farms thus either took electric service or had it within easy reach. By the end of 1951, it is expected that about 96 per cent of the total number of occupied farms will either be served by electricity or will have it available nearby.

Rate Structures Adjusted Upward

During the year, rate structures in various parts of the country were adjusted upward, to compensate for increasing costs, chief among which were a 70 per cent increase in the average hourly wage over 1939, and an increase in the average cost of fuel over that year of more than double. Costs for new construction were also much higher.

From January 1 to December 1, 1948, rate increases for 60-odd companies were approved by regulating authorities, most of them in the latter part of the year, while additional rate increase applications were pending at the end of the period. An incomplete record shows that 115 governmental and municipal systems increased their rates during the same period.

However, despite the effects of inflation on every phase of electricity production, average revenue per kwhr of residential electricity reached a low of 3.01 cents at the end of 1948. Decrease in 1948 was 0.08 of a cent, most of which occurred in the first six months of the year. In 1947 the decrease was 0.13 of a cent, and in 1946 it was 0.19 of a

cent. In the pre-war year of 1939, average revenue was 4.01 cents per kwhr.

This slowing down of the decrease reflects the impact of rate adjustments as present-day electric rates automatically provide lower unit prices for increased use. Increase in domestic use during 1948 exceeded all previous records.

For all ultimate consumers, including industrial, commercial and residential, average revenue per kwhr was 1.79 cents in 1948, as compared with 1.77 cents in 1947 and 2.16 cents per kwhr in 1939.

Sales of Electricity

Showing an increase of about 10 per cent over 1947, total sales of electricity by both business-managed and governmental electric systems were about 240 billion kwhr in 1948. All classifications, except traction, showed substantial gains, with the residential and commercial classifications contributing the largest growth, both being up about 14 per cent over the previous year.

The record installation of generating capacity and additional transmission and distribution facilities needed to serve the great numbers of new customers have brought construction expenditures for all purposes by the business-managed electric companies to a total of about $1,800,000,000 for 1948.

Scheduled to add 15 million more kw of generating capacity in the three-year period, 1949-1951, the business-managed electric companies are expected to make an outlay of over $5 billion for this new construction. With the inclusion of about 3½ million kw to be installed by governmental agencies, total additional generating capacity will amount to about 18½ million kw by the end of 1951.

Revenue Up 11 Per Cent—Net Income Up 2 Per Cent

A new high figure of $3,870,000,000 in gross revenues was reached in 1948 by the business-managed electric companies, as revenues increased about $400,000,000 or 11 per cent, over the 1947 total. Increased expenses absorbed much of the gain in gross revenue, and net income available for dividends and expansion of the business is expected to be about $675 million compared with $656 million the year before.

Payrolls and Fuel Highest Expense Items

Continuing as the largest expense item, payrolls in 1948 were $820 million, having grown $79 million over the 1947 total of $741 million in an increase of 10½ per cent. Fuel was the second largest item of expense, with the biggest relative rise, 31 per cent, over 1947. This increase amounted to $183 million, which brought the 1948 fuel bill to $775 million, as compared with $592 million in 1947. A 12½ per cent gain in the amount of fuel burned in generating the year's record electricity production, was partly responsible for the rise; but the increase in the price of coal or its equivalent in other fuels from an average of $5.62 a ton in 1947 to $6.50 a ton in 1948 contributed heavily to the jump in fuel cost. Taxes were next in line, accounting for $706 million in 1948 against $664 million in 1947.

Business-Managed Companies Report 20.3 Million Kilowatts of Capacity Increases During Five-Year Period

(Comment on New Generating Capacity Installations)

ON the opposite page is a tabulation of the larger capacity additions already in operation, under construction, and scheduled for installation by business-managed companies during the five-year period of 1947-1951, inclusive. Even more additions of capacity are planned for the years immediately following 1951.

The value to the nation as a whole of the increases in capacity being made by the companies included in the listing can hardly be overestimated. Through interconnection and power pooling arrangements, these capacity increases have a potential benefit to areas extending far beyond the service areas of the companies making the installations.

For the five years shown, the expansion program of the business-managed companies listed totals about 20,300,000 kw. An additional 500,000 kw may be added for the smaller companies not reporting, which brings the business-managed total to 20,800,000 kw. Expected installations by government and municipal agencies total about 4,400,000 kw for the period, making the industry total of new capacity about 25,200,000 kw. This is a 50 per cent increase over total installed capacity in 1946.

A breakdown of the totals on a yearly basis shows that the expansion program got under way in 1947 with the installation of about 1,600,000 kw by the companies listed on the opposite page. Governmental agencies of all types contributed an additional 350,000 kw, and the inclusion of capacity installed by companies not reporting brought the 1947 total to over 2,000,000 kw.

In 1948, hampered somewhat by scarcity of materials for new construction, the industry nevertheless broke all previous records for capacity added in a single year by installing over 4,000,000 kw. Some 3,400,000 kw of this total were put into operation by the companies listed. Another 720,000 kw were installed by government and municipal enterprises; and additional amounts were added by other companies not listed.

Peak expansion activity is expected in 1949, as reporting companies indicate a scheduled installation of about 5,400,000 kw. Governmental installation, along with new capacity not reported, will bring the year's total to about 6,700,000 kw. Capacity additions will continue at a high level through 1950, with 4,700,000 kw planned for installation by the reporting companies. Additions by other companies and government agencies will lift the year's total to an estimated 5,800,000 kw.

With the companies listed on the opposite page scheduling 5,200,000 kw for installation in 1951, a near record year is expected. Total installation for that year is estimated at about 6,000,000 kw from all sources.

Marked increases in the figures for 1950 and 1951 may be observed at a later date, however, since new orders not yet recorded may swell the totals.

New Generating Capacity Installations

Reported Larger Installations by Business-Managed Electric Companies; Capacity Additions by Governmental and Municipal Agencies Not Included

(*See Opposite Page For Comment*)

Company	1947	1948	1949	1950	1951
Alabama Power Co.	.....	.....	142,000	.....	100,000
Almno System	68,000	68,000	130,000	140,000	300,000
Appalachian Electric Pr. Co.	.....	.....	137,500	.....	137,500
Arkansas-Missouri Pr. Co.	.....	.....	30,000	.....	.....
Bangor Hydro Elec. Co.	.....	.....	4,000	.....	.....
Black Hills Pr. & Lt. Co.	.....	11,000	.....	.....	.....
Boston Edison Co.	50,000	.....	85,000	.....	.....
California-Oregon Pr. Co.	.....	.....	27,000	.....	.....
Cambridge Electric Lt. Co.	.....	.....	18,000	.....	25,000
Carolina Pr. & Lt. Co.	.....	.....	44,000	44,000	66,000
Central Arizona Lt. & Pr. Co.	.....	30,000	13,000	60,000	60,000
Central Illinois E. & G. Co.	40,000	.....	20,000	.....	30,000
Central Illinois Lt. Co.	.....	.....	35,000	.....	.....
Central Illinois Pub. Ser. Co.	.....	100,000	.....	65,000	.....
Central Kansas Pr. Co.	.....	.....	6,500	.....	.....
Central Louisiana Elec. Co.	.....	15,000	.....	.....	.....
Central Maine Pr. Co.	20,000	18,800	4,000	.....	.....
Central Power & Light Co.	20,000	.....	58,000	.....	33,000
Cincinnati Gas & Elec. Co.	.....	35,000	80,000	.....	100,000
Cleveland Elec. Ill. Co.	.....	.....	167,400	69,600	69,600
Columbus & So. Ohio Elec. Co.	.....	30,000	40,000	40,000	.....
Commonwealth Edison Co. & Subs.	107,000	.....	257,000	150,000	150,000
Community Pub. Ser. Co.	.....	.....	12,500	.....	.....
Connecticut Lt. & Pr. Co.	45,000	31,250	33,000	63,000	63,000
Consolidated Edison Co. of N. Y.	77,500	60,000	160,000	120,000	180,000
Con. Gas Elec. Lt. & Pr. Co. of Baltimore	.....	.....	60,000	66,000	141,000
Consumers Power Co.	.....	170,000	180,000	60,000	.....
Dallas Pr. & Lt. Co.	.....	6,000	63,000	25,000	63,000
Dayton Pr. & Lt. Co.	.....	60,000	60,000	.....	120,000
Delaware Pr. & Lt. Co.	.....	.....	.....	.....	132,000
Detroit Edison Co.	75,000	.....	100,000	100,000	200,000
Duke Power Co.	.....	130,000	70,000	70,000	.....
Duquesne Lt. Co.	.....	.....	78,000	78,000	119,000
Eastern Shore Pub. Ser. Co.	.....	19,000	15,500	.....	30,000
El Paso Electric Co.	.....	.....	20,000	.....	30,000
Empire District Electric Co.	.....	.....	.....	30,000	.....
Fitchburg Gas & Elec. Lt. Co.	.....	.....	.....	10,000	.....
Florida Power Co.	25,000	26,000	12,500	44,000	12,500
Florida Pr. & Lt. Co.	.....	41,000	69,000	40,000	.....
Georgia Power Co.	.....	122,500	22,500	200,000	.....
Georgia Pr. & Lt. Co.	.....	7,000	.....	.....	.....
Gulf Power Co.	.....	.....	22,500	.....	.....
Gulf States Utils. Co.	35,000	5,000	40,000	80,000	80,000
Hartford Elec. Lt. Co.	.....	.....	45,000	.....	.....
Holyoke Water Pr. Co.	.....	15,000	.....	.....	.....
Houston Lt. G. & Pr. Co.	37,500	.....	132,000	108,000	75,000
Idaho Power Co.	16,500	20,700	60,000	69,000	.....
Illinois Power Co.	80,000	42,000	40,000	160,000	100,000
Indiana-Michigan Elec. Co.	.....	.....	137,500	137,500	.....
Indianapolis Pr. & Lt. Co.	37,500	.....	40,000	40,000	40,000
Interstate Pr. Co.	17,000	18,200	11,500	11,600	11,900
Iowa Elec. Lt. & Pr. Co.	5,000	3,500	20,000	25,000	20,000
Iowa-Illinois G. & E. Co.	.....	1,000	45,000	.....	40,000
Iowa Pr. & Lt. Co.	.....	4,640	5,000	40,000	.....
Iowa Pub. Ser. Co.	10,000	7,952	15,000	27,500	10,000
Iowa Southern Utils. Co.	.....	17,920	.....	.....	.....
Jersey Central Pr. & Lt. Co.	.....	.....	36,000	.....	.....
Kansas City Pr. & Lt. Co.	.....	35,000	.....	.....	100,000
Kansas Gas & Elec. Co.	.....	30,000	30,000	.....	.....
Kansas Power & Light Co.	15,000	.....	30,000	40,000	.....
Kentucky Utilities Co.	25,000	25,000	33,000	33,000	33,000
Lake Superior Dist. Pr. Co.	.....	4,000	20,000	.....	.....
Long Island Ltg. Co.	.....	40,000	.....	40,000	.....
Louisville Gas & Elec. Co.	60,000	.....	60,000	60,000	.....
Luzerne County G. & E. Co.	.....	20,000	.....	.....	.....
Madison G. & E. Co.	.....	20,000	.....	.....	.....
Metropolitan Edison Co.	.....	50,500	.....	75,000	75,000
Minnesota Pr. & Lt. Co.	.....	.....	42,000	.....	30,000
Mississippi Pr. Co.	22,500	.....	22,500	.....	80,000
Mississippi Valley Pub. Ser. Co.	.....	.....	.....	.....	15,000
Missouri Utils. Co.	5,000	2,000	8,000	.....	.....
Missouri Pr. & Lt. Co.	.....	4,000	7,500	.....	.....
Missouri Pub. Ser. Co.	.....	7,500	7,500	.....	.....
Monongahela Pr. Co.	.....	.....	50,000	.....	85,000
Montana-Dakota Utils. Co.	6,500	9,000	7,500	.....	.....
Montana Pr. Co.	.....	.....	60,000	.....	.....
Montaup Elec. Co.	35,000	.....	.....	.....	.....
New Bedford G. & Edison Lt.	20,000	.....	.....	33,000	.....
New England Elec. Sys.	40,000	.....	45,000	130,000	70,000
New Jersey Pr. & Lt. Co.	.....	.....	66,000	.....	.....
New York State E. & G. Co.	.....	35,000	.....	79,000	75,000
Niagara-Hudson Pr. Co.	.....	180,000	.....	245,000	90,000
Northern Indiana Pub. Ser. Co.	.....	.....	.....	64,000	60,000
Northern States Pr. Co.	.....	64,360	95,500	94,000	72,500
Northwestern Pub. Ser. Co.	.....	8,175	13,500	.....	.....
Ohio Edison Co.	.....	52,000	60,000	60,000	85,000
Ohio Power Co.	.....	110,000	.....	137,500	137,500
Ohio Pub. Ser. Co.	.....	.....	65,000	100,000	.....
Oklahoma G. & E. Co.	22,500	25,000	57,000	.....	50,000
Otter Tail Pr. Co.	7,500	23,800	13,000	.....	.....
Pacific G. & E. Co.	.....	149,100	191,000	214,000	600,000
Pacific Pr. & Lt. Co.	.....	.....	50,000	.....	.....
Pennsylvania Elec. Co.	.....	30,000	30,000	45,000	40,000
Pennsylvania Pr. Co.	35,000	.....	.....	.....	.....
Pennsylvania Pr. & Lt. Co.	.....	.....	150,000	.....	100,000
Peoples G. & E. Co.	.....	.....	7,500	.....	.....
Philadelphia Elec. Co.	150,000	150,000	132,000	165,000	.....
Potomac Edison Co.	30,000	5,000	39,000	.....	.....
Potomac Elec. Pr. Co.	50,000	.....	80,000	80,000	.....
Public Electric Lt. Co.	.....	5,000	.....	.....	.....
Pub. Ser. Co. of Colorado	5,000	40,000	.....	40,000	40,000
Pub. Ser. Co. of Indiana	.....	47,000	.....	50,000	125,000
Pub. Ser. Co. of New Hampshire	30,000	20,000	40,000	.....	6,000
Pub. Ser. Co. of New Mexico	.....	12,000	.....	.....	.....
Pub. Ser. Co. of Oklahoma	30,000	15,000	6,000	36,000	6,000
Pub. Ser. Elec. & Gas Co. of N. J.	100,000	200,000	100,000	.....	100,000
Rochester G. & E. Co.	.....	40,000	.....	60,000	.....
Rockland Lt. & Pr. Co.	.....	.....	22,000	.....	22,000
San Diego G. & E. Co.	.....	50,000	.....	60,000	.....
Savannah E. & P. Co.	.....	.....	20,000	.....	.....
Scranton Elec. Co.	.....	25,000	.....	.....	.....
Sioux City G. & E. Co.	7,500	10,000	.....	.....	.....
South Carolina E. & G. Co.	.....	.....	.....	.....	20,000
South Carolina Pr. Co.	22,500	.....	.....	22,500	30,000
Southeastern Indiana Pr. Co.	.....	2,160	.....	2,160	.....
Southern California Edison Co.	25,000	167,000	132,000	.....	.....
Southern Colorado Pr. Co.	.....	.....	15,000	.....	.....
Southern Indiana G. & E. Co.	.....	.....	22,600	.....	22,500
Southwestern Elec. Ser. Co.	.....	16,250	.....	.....	.....
Southwestern G. & E. Co.	25,000	15,000	25,000	30,000	30,000
Southwestern Pub. Ser. Co.	5,000	30,000	44,000	36,000	38,000
St. Joseph Lt. & Pr. Co.	.....	.....	.....	.....	20,000
Staten Island Edison Co.	20,000	.....	.....	.....	.....
Tampa Elec. Co.	.....	30,000	.....	60,000	.....
Texas Elec. Service	.....	76,220	50,000	66,000	.....
Texas Pr. & Lt. Co.	.....	7,000	12,500	63,000	.....
Toledo Edison Co.	.....	.....	100,000	.....	55,000
Tucson G. El. & Pr. Co.	.....	4,000	12,000	20,000	.....
Union Elec. of Missouri & Subs.	.....	80,000	.....	160,000	.....
United Illuminating Co.	.....	30,000	.....	30,000	.....
Utah Power & Light Co.	.....	.....	.....	44,000	66,000
Virginia E. & P. Co.	.....	60,000	60,000	60,000	100,000
Western Lt. & Tel. Co.	.....	6,000	10,000	.....	.....
Western Mass. Elec. Co.	.....	.....	45,000	.....	.....
Western Colorado Pr. Co.	.....	3,500	3,500	.....	.....
West Penn Pr. Co.	.....	80,000	80,000	.....	40,000
West Texas Utils. Co.	.....	8,000	15,000	.....	20,000
Wisconsin E. & P. Co.	.....	80,000	80,000	.....	80,000
Wisconsin-Michigan Pr. Co.	.....	.....	17,800	.....	.....
Wisconsin Pr. & Lt. Co.	25,000	.....	25,000	.....	.....
Wisconsin Pub. Ser. Co.	30,000	.....	53,000	.....	60,000
Yearly Total*	1,615,000	3,355,027	5,366,700	4,707,360	5,217,000
Grand Total, 1947-1951*	20,261,087	.....	.....	.....	.....

* *Totals Indicate* Larger *Installations Reported By Business-Managed Electric Companies Only. Capacity Additions By Governmental and Municipal Agencies Are* Not *Included.*

The All-Electric Kitchen Program

By Harry Restofski

Chairman, Commercial Division General Committee, EEI

An address presented at the General Sales Conference Southeastern Electric Exchange, Atlanta, Ga., November 11, 1948

IF all kitchens in wired homes were electrified according to today's standards, the additional electric appliances needed would represent a retail market of $35,000,000,000; operation of these appliances would require more than 165,000,000,000 kilowatthours per year; and they would provide an added annual electric service revenue of over $2⅓ billion. And these figures, big as they are, include only the major appliances—the range, water heater, refrigerator, dishwasher, garbage disposer, and home freezer. Small appliances and good lighting would add substantially to these figures.

The Unsold Market

The great magnitude of this unsold market would, alone, be reason enough for our industry to develop and aggressively use a new All-Electric Kitchen Program. Size of the market is not the sole reason. It is not only tremendously big, but it represents business that is especially attractive because it is stable, it is depression proof, it brings a good price per kilowatthour, it is definitely profitable.

But the most pressing need for a new All-Electric Kitchen Program is not because the market is gigantic or because the business is profitable. Let's back far enough away from the woods so we can see the trees, and the most compelling reason will become clear to us.

There are competitive forces hard at work attempting to destroy the trend toward the electrical way of living. This competition comes from two sources and both are designed to stop the sales gains made with the electric range, the electric refrigerator, the electric water heater, and the electric clothes drier. I refer, of course, to the drives being launched by the gas and the liquefied petroleum industries.

These campaigns cannot be taken lightly. They are intelligently conceived and practically executed. They are aggressive and well financed. They have already commenced their drive on a national scale. These movements are more than just advertising campaigns. They are promotional plans in which the support of the home appliance industry is enlisted in selling *gas* service as against our electrical way of living. Editors of national magazines are also influenced by this program as indicated by the many illustrated articles showing modern gas appliances in the home.

From information received, the American Gas Association will spend $1,400,000 this year on the "Gas Has Got It" campaign. In addition, $8,000,000 will be spent by associated industries—CP Range Manufacturers—to sell the same idea. This is exclusive of all gas range, refrigerator, water heater, and drier manufacturers who are selling the advantages of gas service vs. electricity as a part of this program.

Although we do not have exact figures on the LP-gas program, it is our understanding that their activity is equally as large, if not more so.

These current programs are basically strong for two reasons. They are unified in their effort to coordinate all branches of the gas (or LP-gas) industry, and *they depend upon the inability of the electrical industry to unite* in a cooperative movement *to sell the advantages of electrical living as against gas.*

What Gas Has Got

When reading most trade and consumer publications it is easy to see that the gas industry is in a unified program Most gas appliance manufacturers are advertising not only appliances, but headline the word "Gas." They quite often feature the national AGA slogan, "Gas Has Got It." These appliance manufacturers go still further—they list the benefits of gas service as against electric. Here they are taken from one ad: Gas has the best automatic features, has more modern conveniences, is easy to keep clean, is easier to cook with, cooks better, cooks quicker, is cool in operation, costs less to run, costs less to buy.

Now let use look at the results of our inability to get together in a cooperative program. For the most part the electrical competition is *brand* competition. While tremendously powerful in the aggregate, its utmost potential is not attained because it is concerned only with selling particular makes of appliances. Its sponsors have not had sufficient reason or urging to adequately sell the principle of electrical living.

You can easily see that the electrical industry has failed to stress the advantages of electrical living by examining electric appliance advertising in your own magazines. It is amazing, but true, that very few ever mention the word 'electric', let alone the fact that no attempt is made to sell the advantages of electrical living. True, some manufacturer advertising copy refers to electrical living, and that's all to the good.

Electric Companies' Responsibility

We, the electric companies, and not the electrical manufacturers, are responsible for this situation. Our interest and our stake in electrical living are very great and we are charged with the primary responsibility of continuing the trend toward electrical living, whether we are suffering a temporary shortage in capacity or not. This is not necessarily so with the manufacturer of domestic appliances. His interest is in making that which he can sell at a profit. His product may or may not be operated by electricity. The type he manufactures depends entirely upon the public acceptance of the service available. It may be gas, oil, or coal. It is to our advantage to see to it that the trend continues to be electric, by strongly combating all competition aimed at interfering with that trend.

It is quite significant when we see manufacturers of electric products adding gas lines or intensifying their activity in that field. Today one of the largest electric washing machine companies is, for the first time, making and marketing a gas range. It is using its fast-moving electric appliance dealer organization, and ours, to move this competitive merchandise. A long list of other manufacturers of electric appliances are investing huge sums of money in the manufacture and sale of

gas appliances. They must be of the opinion that we—the electric companies—are not going to maintain the initiative where there is a consumer choice.

We have been so busy trying to meet the electrical demands of our customers that we have neglected to provide the type of national leadership that is necessary to convince America that "We *all* live better electrically." What we need is a good old-fashioned revival on a national scale that will sell not only merchandise but the acceptance of a method of living. We need to sell this idea completely not only as an idea in itself but to the exclusion of any other method of living.

As representatives of electric companies, we must accept the challenge and assume the position of leadership in the national movement. We must prove to manufacturers and others in the industry that we mean business. We also need to state in understandable language the benefits of living electrically so that magazine editors and others indirectly interested in this movement may better understand what we mean when we say, "We all live better electrically."

Selling A Method of Living—The Electric Way

To meet this need for an electrical industry program, the Electric Kitchen and Laundry Committee of the Edison Electric Institute has developed the first part of a complete national consumer activity to sell a method of living—the electric way. It is to be sponsored and carried on by the electric companies in their respective territories, as the practical and economical means of obtaining the objective:

> "To encourage the willing use on the part of the American family of more domestic electric service, and to create the urge to own and the desire to use more electric home appliances."

The All-Electric Kitchen Program is the initial part of a long-range activity. It has been developed and geared to supplement the electrical appliance manufacturers' national advertising, which features brands at the consumer levels, and to complement the NEMA industry promotions at the trade levels. Its first phase is a hard-hitting consumer campaign based on electric living, and has as its immediate goal—"Consumer Education."

The entire All-Electric Kitchen Program is built around the electrical industry's powerful new slogan—

"Of Course—It's Electric"

Here is a slogan that's the answer to scores of questions. Is it automatic? Of Course—It's Electric. Is it clean? Of Course—It's Electric. Does it do a better job? Of Course—It's Electric. Does it save time and work? Of Course—It's Electric. Is it cool—fast—economical? The answer is still, Of Course—It's Electric. Do you recommend it? Is it the most modern? The new slogan still fills the bill when it says, Of Course—It's Electric.

Every individual segment of the electrical industry will be encouraged to give meaning and the widest possible exposure to this consumer statement. This effective slogan—"Of Course—It's Electric"—may well become a fixed part of every consumer activity that will be carried on throughout your entire territory.

The Electric Kitchen and Laundry Committee of EEI will exert every effort with electric appliance manufacturers for their adoption of this electrical industry slogan. Every national advertiser of any kitchen product will be encouraged to make this slogan—"Of Course—It's Electric"—a part of his national brand consumer advertising campaign.

By interpreting and by giving wide exposure to the meaning of this slogan, the consuming public will be conscious of the fact that a modern kitchen is an all-electric kitchen. No phase of homemaking is closer to the heart of the American family than kitchen activities.

"Kitchenizer's Digest"

Through the use of materials developed in the All-Electric Kitchen Program the American family will be given believable reasons why "an all-electric kitchen serves you better and saves you more."

The spearhead of the program is a remarkable 40-page book (6½ by 9 in.) known as the "Kitchenizer's Digest." It is the most authoritative, complete, and helpful book ever prepared to sell the all-electric kitchen idea.

One of its most unusual qualities is its contents. Ten of the nation's leading authorities on kitchens and kitchen planning have contributed to the editorial make-up of the "Kitchenizer's Digest." Here are the editors that you and your customers are acquainted with: Elizabeth Sweeney of *McCall's Magazine*, Elizabeth Beveridge of *Woman's Home Companion*, Edith Ramsay of *American Home*, Leonore Sater of *Farm Journal*, Katherine Fisher of *Good Housekeeping*, Charlotte Eaton Conway of *House Beautiful*, Helen Stark of *Better Homes and Gardens*, E. G. Gavin of *American Builder*, Frances Armin of *Adequate Wiring Reporter*, and George Palmer Scott of *Architectural Forum*.

This book tells how to kitchenize. Kitchenizing means—(1) an all-electric kitchen, (2) adequate and proper wiring, and (3) the proper treatment of the three all-electric, time-saving kitchen centers. The "Kitchenizer's Digest" is profusely illustrated, and many of its pages are in color. It contains facts, figures, and definite suggestions on color, decoration, equipment, arrangement, financing, planning, and other considerations relating to the installation of an all-electric kitchen.

Wide Distribution Necessary

With the electrical industry slogan—"Of Course—It's Electric"—the All-Electric Kitchen Program is largely built around the "Kitchenizer's Digest." The success of the plan depends upon the use of this book by the electric companies. Wide distribution of this "Kitchenizer's Digest" to utility customers in every part of the country will, without doubt, influence manufacturers to incorporate the slogan "Of Course—It's Electric" in their advertisements featuring electrical appliances. Without such support by electric companies, it is difficult to see how these same manufacturers could afford to join this movement.

Suggested ways to obtain low-cost distribution include newspaper ads, radio spot announcements, outdoor posters, regular customer contacts. Other good means for obtaining controlled distribution are at women's club and other meetings, cooking schools, home economics classes, utility displays and exhibits, home shows, and model homes.

With good distribution of the "Kitchenizer's Digest" as the key to a successful industry movement, the program has included many promotional aids for use by electric companies at the local level. Included are several newspaper ads in a number of sizes and a variety of copy slants. These ads are available either in mat or electrotype form and all feature the "Kitchenizer's Digest."

A complete radio spot announcement

recording program will be available. The announcements all pertain to the "Kitchenizer's Digest," and include an invitation to visit your display rooms or offices to obtain a free copy. Each recording contains sufficient spot announcements for an entire week's program.

Three 24-sheet, outdoor posters are available in color. Ample space for your company imprint has been provided.

A wealth of other material is included in the plan so that all your present and future domestic electric customers will be acquainted with the advantages of an all-electric kitchen through the "Kitchenizer's Digest." A few of them are window cards and decals, easel frames and posters, envelope inserts, post-card imprints, postage meter messages, truck posters, and pin-on badges.

"The Constant Bride"

Of special interest is an outstanding 27-minute, color motion picture, "The Constant Bride." It is now being professionally produced by Wilding Picture Productions, Inc. All of the thirty utility people who have read the script are high in their praise of this story. It should fill a great need for this kind of an educational picture to be shown by utility companies to women's clubs, luncheon clubs, cooking schools, home economics classes, company employees, electrical organizations, fraternal gatherings, and in local motion picture theaters.

All of the above material is now being prepared and will be ready for distribution to electric companies in January, 1949. This includes the motion picture. When the entire Plan Book comes off the press and the material is ready, previews will be held for the trade press, magazine editors, NEMA, NEWA, NECA, and others directly or indirectly interested in this industry activity.

However, one thing must be done immediately in order to gain the momentum needed to launch an all-industry program. On two items — the "Kitchenizer's Digest" and the motion picture—it is necessary to have substantial advance orders from electric companies not later than December, 1948.

In the case of the "Kitchenizer's Digest" the production cost for 100,000 copies is 21 cents each. In lots of 500,000 it is 10 cents each. Everyone agrees that a 10-cent price is necessary to make possible the widespread distribution that is essential if the Digest is to serve its intended purpose. Only through advance commitments is it possible to order the very substantial quantities necessary to obtain prices so low as to put the books in the bargain class.

A somewhat similar situation applies in the case of the motion picture. While the original contract cost of production is $37,000 for the master print, the cost of copies will depend upon the number purchased on the first order. In other words, the volume of the first order will largely establish future prices of this film.

In order to get the benefits that result from large-scale buying, the committee requests every company to support this all-industry movement by placing orders as soon as possible for the "Kitchenizer's Digest" (5 per cent of meters has been suggested as a minimum figure) and one or more prints of the motion picture.

At a recent presentation of the program, fourteen companies indicated they would place initial orders for an aggregate of 199,000 copies of the Digest and twelve of them made commitments to buy the film.

Keep in mind the fact that the Digest and movie will be usable for some years to come. Every effort has been made to eliminate anything that would date them. For those who cannot use the material for six or twelve months, this is important and means that they need not hesitate to place orders now.

The EEI Committees are not just selling literature. They are selling an idea that can be the start of a great all-industry movement. The orders for material are merely the evidence for everyone concerned that the utilities are ready and anxious to back this program. It is this support that will convince manufacturers and others that we are prepared to assume the leadership in this effort to sell America the idea that "We all live better electrically."

Do you wonder if a step of this kind is timely? It's a good question. 1947 was the biggest year in electric appliance history. For the first time the sales of electric ranges and electric water heaters each exceeded the one million mark by a comfortable margin. And 1948 promises to equal or excel last year's results. But let's not forget that last year 620,000 LP-gas ranges were sold. Just think about that. Here is a brand-new industry that has leaped to maturity in just a few years and that has already proved itself so capable and aggressive that in 1947, the number of LP-gas ranges sold was over 50 per cent of electric range sales.

Yes, the program is timely. Consider these facts. Some companies have spare capacity *now* and need this program *now*. Others are getting into that position each month. Even where generating capacity is in short supply, the program materials can be used. The "Kitchenizer's Digest" and the motion picture are educational and in no sense high-pressure selling tools. They pave the way for aggressive selling whenever you are ready for it. They pre-sell your market and hold it for you until you can handle the additional business. And it is certain the time will come when you will want more of it.

Large scale changes in public opinion cannot be brought about quickly. It will take many, many months of effort on our part before a really large percentage of the public is fully sold on the benefits of electrical living. It will take even longer before the results of this program can be an important factor in our peak loads. By the time that could happen, most of us will have more adequate capacity reserves.

4-Point Value

Here are four questions whose answers all point up the great value of the new All-Electric Kitchen Program:

1. Does your company need more stable business to balance the rapidly growing industrial loads? The All-Electric Kitchen Program *will help you get it.*
2. Are you concerned over LP-gas inroads in your service area? The All-Electric Kitchen Program *is made to order for you.*
3. Does a temporary tightness in generating capacity prevent you from going all-out on sales? The educational approach used in the All-Electric Kitchen Program *just fits your needs.*
4. Do you need more high-profit business to support greatly increased expenditures for generating and other facilities? Look to the All-Electric Kitchen Program *to help solve your problem.*

And now, this closing word. You will receive from EEI in the near future your copy of the Plan Book for the All-Electric Kitchen Program. Look it over carefully. See how well designed the promotional materials are to fill your company's needs. Put them to work for you just as soon as possible.

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Third National Farm Electrification Conference Reports Improvements of Farm Living Standards

Large Attendance Displays Record Interest in Changes Electricity is Making in Farm Scene

ELECTRICITY'S role as a versatile working partner with farm families, improving their farming and living standards, was discussed from many standpoints at the Third National Farm Electrification Conference held in Chicago, November 17-19. Attending the meeting and taking part in the program were several hundred representatives of electric companies, rural electric cooperatives, agricultural schools and colleges, electrical and farm publications, government agencies, and others.

Adequate wiring of farm homes and buildings was stressed throughout many speeches and group discussions. It was emphasized that farmers need help in planning their wiring systems; that many difficulties with unsatisfactory performance of electrical equipment are due to the expansion of the farmer's use of electricity, which has exceeded the most optimistic predictions of future growth at the time when many wiring systems were designed, and that, where new customers are concerned, assistance in planning farm wiring should be offered well before the farmer has been added to the power line.

Rusk Elected '49 Chairman

H. P. Rusk, Dean and Director of the College of Agriculture, University of Illinois, was elected Chairman for the 1949 National Farm Electrification Conference. Titus B. Schmid, President, Crescent Supply Company, Dubuque, Iowa, was elected Vice Chairman, Karl Gorham, business manager, *Electricity on the Farm* magazine, New York City, is the new Secretary-Treasurer.

The Regional Vice Chairmen, all re-elected, are: Northeast, R. B. Corbett, University of Maryland, College Park, Md.; Northwest, J. B. Rodgers, Oregon State College, Corvallis, Ore.; Southeast, P. D. Sanders, Virginia State Grange, Richmond, Va.; Southwest, P. T. Montfort, A & M College of Texas, College Station, Texas; Midwest, H. E. Slusher, Missouri Farm Bureau Federation, Jefferson City, Mo.; Western, E. G. Stahl, Pacific Gas & Electric Company, San Francisco, Calif.

The 1949 meeting will again be held in Chicago, with the date to be announced.

Chairman Frank Watts Opens First Session

With population increasing and the last of the nation's 25,000,000 untilled acres slated for cultivation within the next five years, produce surpluses soon will become only "nightmares of past generations" and farm prices will become stabilized, Frank Watts, of *Farm Journal*, and Chairman of the 1948 Conference, declared in the opening address.

Current prosperity of farmers has enabled them to start rehabilitation and reconstruction of their "operating plants," to meet future needs, he said. Farmers must think in terms of producing more food per available acre, he continued, predicting that the time will come when population will be too large to be fed on the present traditional "three acres of land per capita."

"It is then," Mr. Watts declared, "that generations to come will profit indirectly from current high farm income, which has enabled farmers to rebuild depleted soil and equip their food factories with the necessary equipment and electric power so that their grandsons and granddaughters can help feed and clothe a nation which suddenly finds itself too big for its agricultural breeches."

College Extension Departments play a vital role in providing farmers with the information necessary to enable them to use electricity wisely, economically and profitably, the Conference was told by Dean Rusk. "The Extension Service in Agriculture and Home Economics has been the most potent factor in developing group action among rural people since the passing of the old barn raisings of pioneer times. And in no part of our advancing farm economy has group action been more effective than it has in the expansion of the use of electrical energy," he asserted.

How the Chamber of Commerce of Ashland, Ohio, brought together under one roof the major productive uses of electricity on the farm in actual operation, with the objective of filling the farmer's need for education in the proper use of electrical farm equipment, was described for the Conference by C. D. Leiter, sales manager of the F. E. Myers & Bro. Co., of Ashland. Some 40 types of electrical equipment were on display, with speakers who covered adequate wiring, farm lighting, mow hay curing and other important electrical applications, in a two-day meeting.

Wednesday Afternoon Session

George A. Rietz, manager of the Farm Industry Division, General Electric Company, served as Chairman during the second session of the Conference, which opened with brief statements on the topic, "Changes Electricity Has Brought About on Our Farm and in Our Community," by four farm wives. Mrs. Edith Kays, Ottawa, Ill.; Mrs. Helen Warns, Walbridge, Ohio; Mrs. Clara Talleur, Greenville, Ill., and Mrs. C. R. Watters, Dwight, Ill., joined in this presentation.

John Strohm, Associate Editor of *Country Gentleman* magazine, told the audience that "defense alone will not whip Communism," and urged that the United States "embark upon a positive program in the field of international relations."

As an example of the "positive approach" thus recommended, Mr. Strohm described the present activities of American farm experts in Saudi Arabia, whose work, he said, will "lay the foundation

for an agricultural program which will help that country to produce all its food needs, instead of 25 per cent, as it is now doing . . . our agricultural methods, technique and science can do more to help other countries to help themselves than any other single thing I can think of."

The first panel discussion, on "What Power Suppliers Are Doing to Inform and Help Farm Families Electrically," was led by Karl Gorham. On the platform were P. E. Brookover, Public Service Co. of Colorado, Denver, Colo.; J. C. Cahill, The Detroit Edison Co., Detroit, Mich.; Walter Baker, Alabama Power Co., Birmingham, Ala.; V. C. Kallahl, Southwestern Electric Cooperative, Greenville, Ill.; Clarence Reeds, Oklahoma Statewide Electric Cooperative, Norman, Okla.; Fred Shaw, Texas Power & Light Co., Dallas, Texas, and Frank Warner, Huntington County R.E.M.C., Huntington, Ind.

Members of the panel emphasized the need for continuing education of the farmer in proper use of electrical applications, and outlined the experiences of their organizations with such activities as group meetings, personal contacts through rural service representatives, joint demonstrations with agricultural schools and colleges, films and other methods.

Size of Agricultural Market Described by Speaker

The morning session on Thursday, Nov. 18, was headed by Wilfred Shaw, secretary-treasurer of the American Farm Bureau Federation, who served as chairman.

First to be heard was Mrs. Charles W. Sewell, administrative director of the Associated Women of the American Farm Bureau Federation, who told the Conference that "for every dollar spent to build a rural electric line, the farmer stands ready to spend four and a half dollars for appliances."

"Farmers can no longer afford to maintain smug complacency and take no part in the troubles between other segments of this nation's economic life," L. M. Knox, a farmer of Morrison, Ill., advised. Increased use of electrical equipment and appliances means that the farmer "is now vitally interested in whether or not John L. Lewis' miners go out on strike, because less and higher priced coal may mean less and higher priced electricity."

The second panel discussion, on the topic "How Dealers Should Meet the Farm Family's Needs Electrically," was headed by C. C. Simpson, managing director of the National Electrical Retailers Association. The group included Donald Womeldorff, General Electric Supply Corp., Chicago, Ill.; T. R. Rosencrans, Paw Paw, Ill., a dealer; W. H. Tammeus, Woodstock, Ill., a county agent, and B. F. George, Spring Valley, Ill., a dealer.

The farmer's vital interest in being able to obtain prompt servicing for his electrical equipment, and the need for dealers to maintain competent servicemen, preferably farm trained, along with ample stocks of replacement parts, were mentioned by most of these speakers. Retailers should carefully survey their areas to determine what equipment is needed by local farmers, and should make every effort to anticipate their customers' needs.

Invited to address the Conference, Claude Wickard, REA administrator, pointed out that the "authoritative push of a button can put electricity to work," but unless the farmer has put that electricity to work effectively, economically and wisely, he has not achieved maximum results from his high line service. The administrator cautioned all groups represented at the Conference to cooperate in providing rural people with all possible information about the proper selection of equipment, and the means of putting that equipment to work so that it will provide maximum benefits.

Thursday Afternoon Session

The fourth session of the Conference, with C. D. Leiter in the chair, opened with an address prepared for delivery by B. W. Clark, vice president of the Westinghouse Electric Corporation, Pittsburgh, Pa. In his absence, the speech was read by L. R. Emmert, director of rural electrification for Westinghouse.

In the next decade, farmers will invest $4 billion in electrical home appliances, and another $1,350,000,000 for electrical components, such as motors and controls, Mr. Clark predicted. Comparably huge sums will be spent for farm production machines, he declared.

"By 1957 the nation's total power sales are expected to reach 374 billion kwhr, of which farm sales are estimated at 21.6 billion kwhr. On this basis rural America's power load in 1957 will be 240 per cent of 1947 figures . . . and if farm incomes continue relatively high, and hired men continue difficult to get and hard to keep, actual farm demand for electric power may show an additional rise of 30 per cent over present estimates," Mr. Clark said.

New developments in the field of crop conditioning and processing were described for the Conference by Arthur W. Turner, head of agricultural engineering research for the U. S. Department of Agriculture, who said that within five years crop conditioning units, such as artificial corn driers, may be as common on farms in some areas as are corn pickers and combines. Such equipment will be largely electrical, and will mark another new milestone in agricultural progress, he added.

A discussion of "How Home Economists Shoud Help Meet the Farm Family's Needs Electrically" was led by Selma Andrews, manager of the Hotpoint Institute, Hotpoint, Inc., Chicago. Listed as members of the panel were Naomi Shank, Iowa State College, Ames, Iowa; Gertrude Drinker, Farmers Home Administration, Washington, D. C.; Louisan Mamer, REA, Washington, D. C.; Ruby Rolls, homemaking teacher, Hebron, Ill.; Elizabeth Parker, home service director, Georgia Power Co., Atlanta, Ga.; Verna L. Miller, director, Home Economics Dept., Frigidaire, Dayton, Ohio; and Lucile Smith, rural home editor, *Capper's Farmer,* Topeka, Kans.

Role of Farm Press Described in Closing Session

With Frank Watts again in the chair, the last session of the Conference was launched with a panel discussion of the topic, "How the Farm Press and Radio Should Meet the Farm Family's Needs Electrically." Robert H. Reed, editor, *Country Gentleman,* headed the group, which included Frank Bill, farm editor of the *Bloomington Pantograph,* Bloomington, Ill.; Alvina Mattes, home economist, Dubuque, Iowa; John Strohm, associate editor, *Country Gentleman*; C. A. Hughes, county agent, Cook County, Ill.; T. H. Hafer, manager, Corn Belt Electric Cooperative, Bloomington, Ill.; and Claude Pagles, an Illinois farmer.

The value of the farm press, in quickly bringing news of new electrical applications to mass audiences, was emphasized. Specific information on the proper use of both home appliances and productive equipment is always welcomed by farm readers, panel members declared. Photographs and illustrations showing

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Specifications and Statistical Sampling

By J. J. Taylor

Chief Engineer, Barberton Division, Ohio Brass Company

An address before the Fall Meeting of the Transmission and Distribution Committee, EEI, Swampscott, Mass., October 11, 1948

IN attempting to write a specification that may serve as a contract basis between producer and consumer our first effort should, perhaps, be to find a common interest between the two parties: an adequate product produced for service and maintained in service at the least expense of human effort. In the long run the consumer must carry expense incurred by the producer in either creating the product or testing it. It is therefore to the consumer's interest to see that the destruction of test samples and the time taken in running acceptance tests is held at the minimum level consistent with a reasonable risk.

In general, the common interest is a reasonable risk rather than zero risk. Risk-taking is part of the business of good engineers and executives.

Having agreed on a common interest and on the reasonableness of risk-taking, we attempt to contrive tests that establish the conformity of a current shipment with previous manufacturing history of the producer and that tend to promote desirable and uniform practices by the contributing industry. The tests run on the product at the time of acceptance are not necessarily "service-in-miniature" tests nor are they "service-exaggerated"; they are artificial measures of performance against an artificial par. The excuse for such tests is that over many periods of manufacturing and using history it has been found that a product meeting these artificial measurements of performance gives adequate and satisfactory service to the consumer.

A purely technical problem exists in almost all specification clauses and this is to get the maximum amount of information out of relatively small samples and to evaluate risks with an accuracy commensurate with the time, effort and money allowed for acceptance testing.

To illustrate the existence of risks in specification testing and to show the part contributed by a statistical approach, we might consider the following example: A certain producer of insulators was asked by a midwest consumer for a suspension insulator that would have an average strength of 20,000 lb. Approximately 100 of these special insulators were needed for a new construction.

The sales manager for the company called in his engineer and asked if such an insulator could be produced and was told that, by an odd coincidence, 100 trial units of a new design were at that moment awaiting test and that due to new features incorporated into the design they might satisfy the proposed requirement. Since the average strength of the batch of 100 insulators was unknown, the sales manager asked for an immediate test to ascertain this figure. The engineer selected at random the three units marked in Fig. 1. They were tested and showed the listed values of sample No. 1:

20,500 lb
20,500 "
22,500 "

Average 21,100 lb

Very much gratified with this fine performance, the sales manager wired the consumer that he could supply 97 insulators that would average 20,000 lb.

Over the next day or so the engineer kept asking himself uneasily, "Am I really as good as that?", and reached finally a level of doubt where he decided to test three more insulators to make sure. From the same batch he selected at random three more units (Fig. 2) and ordered these tested. He was much perturbed to see that they did not average 20,000 lb and in fact barely averaged 19,000 lb. He called the attention of his sales manager to this disturbing development, who in turn wired the customer regretting that the promised average would have to be reduced to 19,000 lb and that they would have only 94 insulators to ship. The customer wired back that they were not happy about this change but that their inspector was

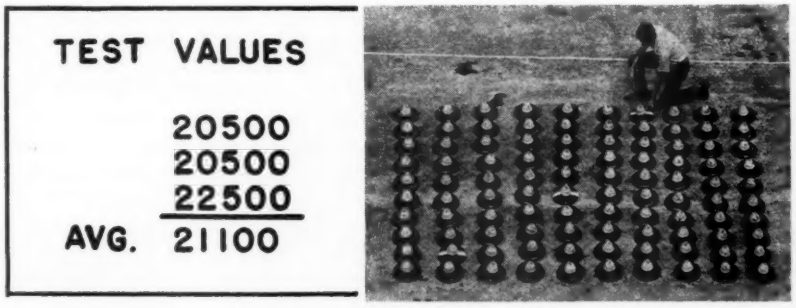

Fig. 1—Sample No. 1 of Three Insulators Selected at Random and Test Values

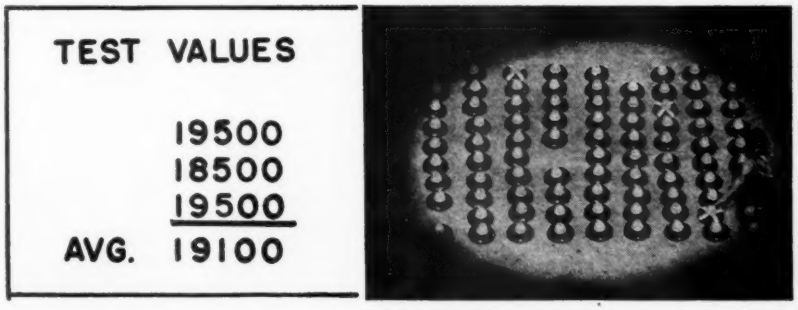

Fig. 2—Sample No. 2 of Three Insulators Selected at Random and Test Values

on his way to the factory and would run an acceptance test there.

The inspector again sampled the batch of insulators (Fig. 3), and had the misfortune (or was it good fortune) to select three samples that averaged 17,800 lb, one of which had a strength of only 16,500 lb. He advised the producer that the results were most disappointing and that the whole batch of insulators was obviously erratic and unreliable. A rejection of the batch was confirmed later in the same day.

After the nine specimens had been tested, the engineer examined carefully the high and low units but could see no significant difference in the details of assembly or peculiarities of the fractures. It was decided that since the units were already rejected the whole remaining 91 insulators should be tested to destruction in an attempt to find out why the performance had been so variable from one sample to another.

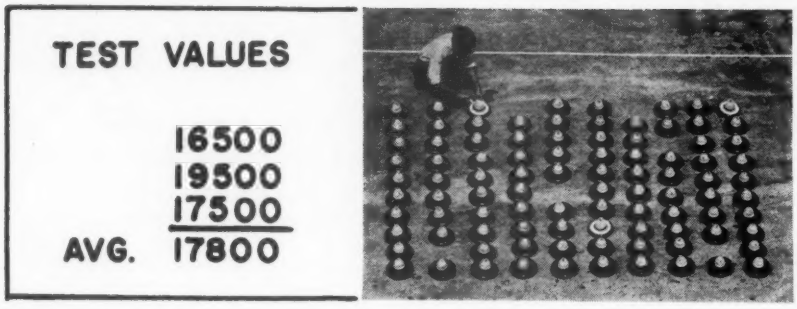

Fig. 3—Sample No. 3 of Three Insulators Selected at Random and Test Values

Developing a Pattern

The engineer, though a confirmed optimist, was also an orderly person, so prior to the test of the large quantity he had chalked out on the laboratory floor a base line divided into different ranges of strength so that, as the units were broken, they could be placed in an appropriate panel or cell. The three different samples arranged in their proper place on this base line seemed to have no significance (Fig. 4). Tests were continued until all of the remaining 91 insulators had been broken and arranged in place (Fig. 5). About that time the sales manager, who had been walking along a balcony that looked down directly onto the floor of the test room, called out to the engineer, "Well, Bill, you may not have satisfactory insulators but you do seem to have developed a pattern."

I am sorry to relate that the significance of this pattern did not dawn immediately on our two characters. We disregard at our peril any basic natural law, and there are very few natural laws more firmly established or more thoroughly known than the inclination of test values to group themselves in a more or less predictable pattern about a central tendency.

Basic Distribution Curves

The cross-section of a straw pile made by a threshing machine has usually the bell-shaped curve that is of so much interest to us statistically; the back-stop behind targets on a firing range is hollowed out into the same characteristic cross-section; a shotgun blast fired into a heavy wood structure gouges out a recess that is deep in the center and that fringes off gradually to a mere speckling of pellets. We might pause for a moment to ask ourselves what lies back of this natural law.

Adverse and Favorable Factors

The performance of product aside from what we might class as obvious and assignable causes is determined pretty largely by the number of factors in a single specimen that are favorable and the number of factors that are adverse. We might think of each favorable or adverse factor as a head or tail in our handful of pennies. When many favorable factors exist in a specimen it is a maximum specimen of our distribution, and when many unfavorable factors exist in a specimen it turns out to be, on test, a minimum specimen of our distribution. I do not know whether these factors are numbered by fives, tens, hundreds or thousands. We know only that there are enough of them to give a distribution of recognizable shape and this argues that the number is fairly great.

If you were to take a handful of pennies, let us say twelve of them, and

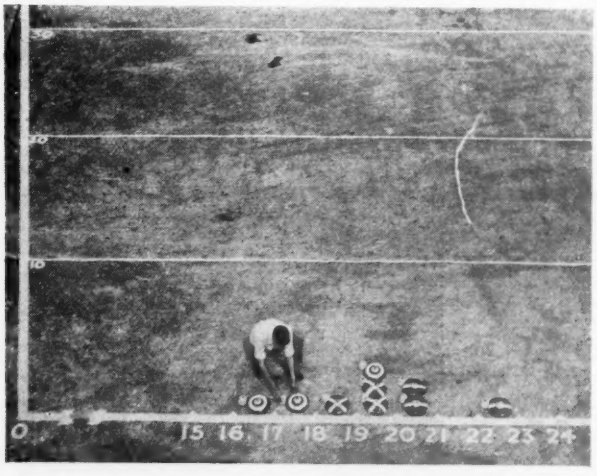

Fig. 4—Distribution on Graduated Base Line of 9 Insulators Tested in First Three Sample Tests

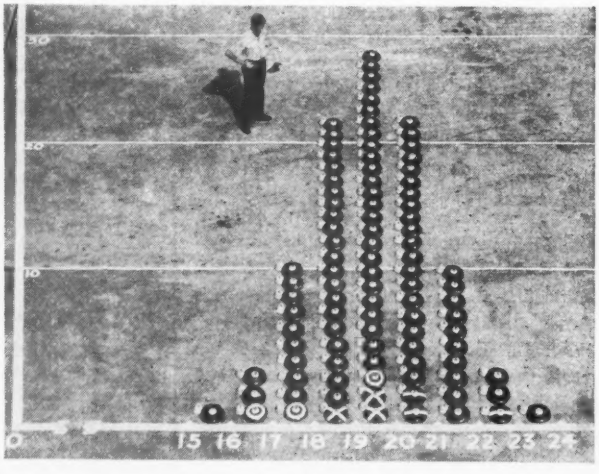

Fig. 5—Distribution on Graduated Base Line of Whole Batch of 100 Insulators Tested to Destruction

throw them all up in the air at one time you would not be surprised if you observed six heads and six tails or five heads and seven tails or even perhaps four tails and eight heads. But you would be very much surprised indeed if on one toss all the heads came up or all the tails came up.

Coming back to the subject of the 100 insulators, if in place of each insulator we substitute one toss of the handful of pennies, then the center column might represent 28 tosses in which heads and tails were equal in number. The column resting on the 18,000 and 19,000-lb base line might represent the 22 tosses in which there were five heads and seven tails. The column resting between 20,000 and 21,000-lb might represent the 22 tosses in which there were five tails and seven heads, and so on.

Insulator Variables

Although not a complex device, insulators have promise of many variables, starting with the nature of the raw materials and following through a multiplicity of manufacturing operations. We have no reason to suppose that we will lack a sufficient number of favorable and unfavorable factors to give all tested characteristics the nature of a distribution and, in some instances, to give this distribution considerable width.

If this is a valid premise, and I think it is, then we have a very real interest in two measurements that relate to any test performance. One of these is the central tendency about which the various specimens are dispersed and the other is the width of this dispersion. If we wish to consider other refinements normally debated by statisticians, we have a third interest in the shape of the dispersion pattern as well as its width. Examples can be found of dispersions that depart very considerably from the so-called normal curve and certainly minor modifications of the normal curve are to be expected (Fig. 6).

As a general rule, however, in a dispersion not rendered unnatural by some artificiality of design or of proof testing it is expected that there will be very few specimens at the upper and lower limits of the dispersion and a very heavy clustering around the average value. I think that the normal curve assumption is good enough for our purposes and since it is very easy to work with and all its properties are completely tabulated for ready reference we might consider this favorably with the general thought in mind that we should learn to walk before we learn to run.

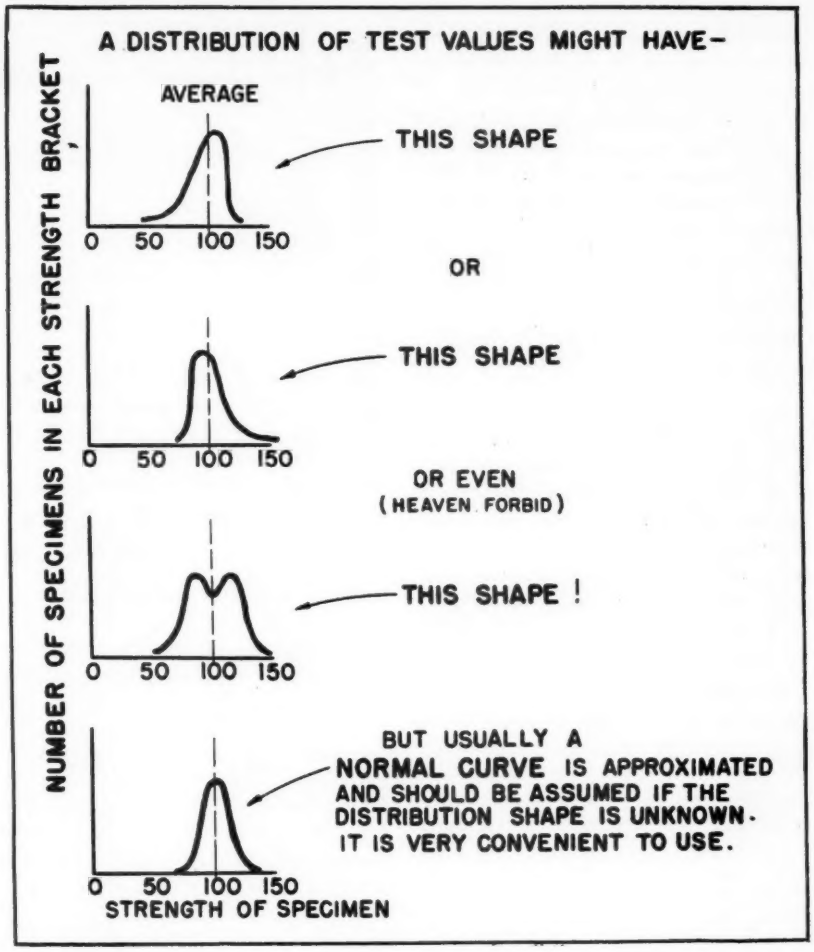

Fig. 6—Curves Showing Minor Modifications in Dispersion Pattern Which Would Be Possible, As In the Case of Distribution of Test Values of Insulator Strength

To describe the properties of these dispersion patterns, statisticians have assembled a simple method of nomenclature very suitable to our purpose (see also Fig. 8):

The test value of an individual specimen is X.

The average of a sub-group is $\overline{X}$.

The average of the sub-group averages is $\overline{\overline{X}}$.

The range of a sub-group is R.

The average of the sub-group ranges is $\overline{R}$.

In the above tabulation, range R, the spread between the highest and lowest value of a sub-group, is used to indicate the width of the dispersion. A statistician might prefer to use standard deviation, which is the square root of the average of the squares of the deviations of the numbers from their average $\overline{X}$. In our particular business we usually deal with small sample sizes chosen for destructive tests. For these small test groups the "range" is a good statistic and probably all that the precision of our testing warrants. Moreover it doesn't need any particular calculation and is familiar to all of us. One precaution is necessary, a consistent size of test group: for obviously the "range" of a single specimen is 0 and the range for a whole batch of product may be large. "Range" is a function of the size of the test sample.

In almost any dispersion pattern of test results the tail ends of the distribution to the right and left of the central tendency taper off in a most unsatisfactory way into contact with the X axis.

It is impractical therefore to draw a line that defines the intersection of the distribution and of the X axis and to call this the "minimum strength unit."

It is this peculiarity of test specimen distributions that makes the definition of a minimum unit so cloudy an issue. If, for instance, we elect to specify a minimum strength that will be met 999 times out of 1000, what test procedure could we imagine that would check whether or not it is so met? Certainly we cannot hope to detect the existence of such minimum units by testing a half dozen insulators out of a batch or universe of several thousand. To be practical we have almost no choice except to permit a certain percentage of non-conforming specimens and then try to set up a test procedure that will detect batches with a non-conforming percentage greater than a specified amount. A non-conforming percentage of about 3 to 4 per cent would appear to be about the right order of magnitude.

Knowing $\overline{\overline{X}}$ and knowing $\overline{R}$, and assuming a normal curve of distribution, the characteristics of a batch of insulators can be studied quite completely and a conclusion can be reached regarding the number of specimens likely to test above or below any arbitrarily chosen test level. $\overline{\overline{X}}$ and $\overline{R}$ cannot be determined from a single small sample, but if we know $\overline{\overline{X}}$ and $\overline{R}$ for the type of insulator being tested then we are in a position to set up on either side of each characteristic limits within which the $\overline{X}$ and R of a small sample should lie. The procedure then is to "type" the supplier's product and to use the small test group only to check probability of trueness to type. More than this cannot be done with a small test group.

Sample Calculations

Fig. 7 shows a normal curve in greater detail and Fig. 8 illustrates two methods of calculating statistical data from test observations. Results from either the method of deviations or the method of ranges are about equivalent. When limits have been established for a product it is necessary to test only a single group of say 3 or 5 specimens and determine that the average of the test group and the range of the test group both come within established limits.

With these ideas in mind we might return for a moment to the sampling experiment discussed earlier in this paper. In sample No. 1 the range of three specimens was 2000 lb. With this value in mind and a table of statistical data near at hand, the engineer should have suspected that his average might be at least 2000 lb in error. He should have limited his commitment to stating that the average was in the order of 19,000 to 23,000 lb. Had he presented this vague but justifiable answer he would almost certainly have been asked to narrow it down by running additional samples. He could hardly expect to determine a reliable average in less than 10 specimens nor a reliable figure

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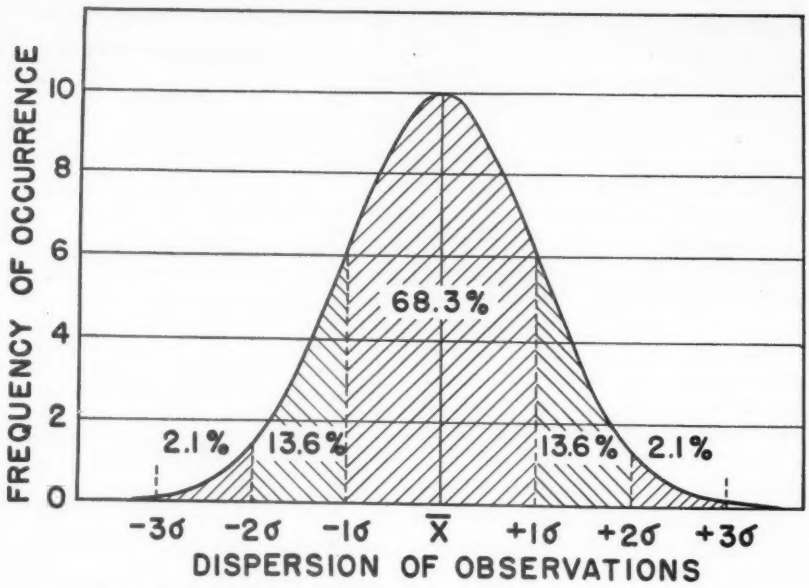


Fig. 7—Detail of Dispersion Shown Under a Normal Distribution Curve

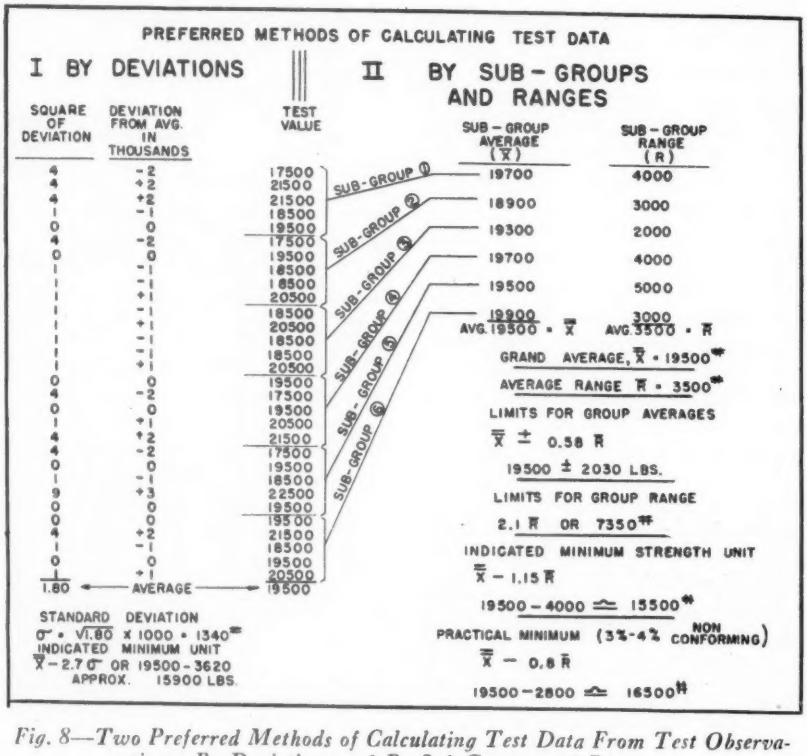


Fig. 8—Two Preferred Methods of Calculating Test Data From Test Observations: By Deviations and By Sub-Groups and Ranges

The Next Twenty-Five Years in Accident Prevention

By K. R. MacKinnon

President, Ebasco International Corporation

An address before the Public Utilities Section, of the 36th National Safety Congress, Chicago, Ill., October 19, 1948.

SOME of you may ask "Why should anyone worry about the next 25 years in accident prevention work?" You may say "What we need is action *now* to stop the accidents that are occurring every day with distressing regularity. Take care of today and the future will take care of itself."

Value of Prediction

The reason for discussing what may happen during the next 25 years is because accidents follow definite trends, and it is only by reviewing what has happened in the past, that we can predict what is going to happen in the future. Only by reviewing past progress can we determine how our future efforts should be directed.

Today, in the year 1948, accident prevention is a recognized function of good management in business. There are very few utility companies who do not carry on safety work as a part of their normal functions. This Congress is in itself proof of the fact that all types of industry recognize the importance of safety work. This utility group here today, composed not only of safety directors and personnel men, but executives and operating men, is evidence that in general our utilities are alive to the importance of accident prevention work.

Perhaps you do not realize that 25 years ago we could not make that statement. Although at that time many utility companies were carrying on safety work, a great many more were doing little or nothing about accidents to their employees. It was not until 1926 that any effort was made to find out how many Fatal and Lost-Time Accidents were occurring in the electric industry. During that year statistics were collected for 1923, 1924 and 1925, and have been collected every year since.

The gas industry started collecting statistics in 1919 and have made them public since 1929. The accident records for the Bell Telephone Companies as a group run back to 1922.

I would like to compare the results of the various units of the Public Utility Section for the good we can all get out of it. The electric, gas and telephone companies have worked together to their mutual advantage on such matters as conduit and pole line locations in the streets and highways and other joint construction problems. They can profit even more by a continual exchange of experiences in the field of accident prevention.

When electric utility statistics were first assembled in 1926 many safety men were surprised to find how regular they were. They thought that with so many different kinds of companies, types of plants, programs of construction, etc., there would be wide variations in the number of accidents occurring. It was found that the fatal accidents per thousand employees for the years 1923-25, for all reporting companies, ran 1.68, 1.60, 1.80.

The publication of those figures caused some serious thinking in the industry. They showed that over 400 men were being killed every year while engaged in their normal activities. It seemed a terrible toll of human life. Why was it so high? Was it necessary? What could be done about it?

A Declining Accident Rate

What *was* done about it is shown in the curves of accidents for the period 1923-1947, seen in Fig. 1.

The top curve is the number of Lost-Time accidents per 100 employees per year for the electric utility industry. You will note that from 1926 until 1933 the rate dropped rapidly. It showed no further improvement until 1939, and has been climbing steadily ever since.

The bottom curve shows fatalities per 1000 employees per year. This rate also

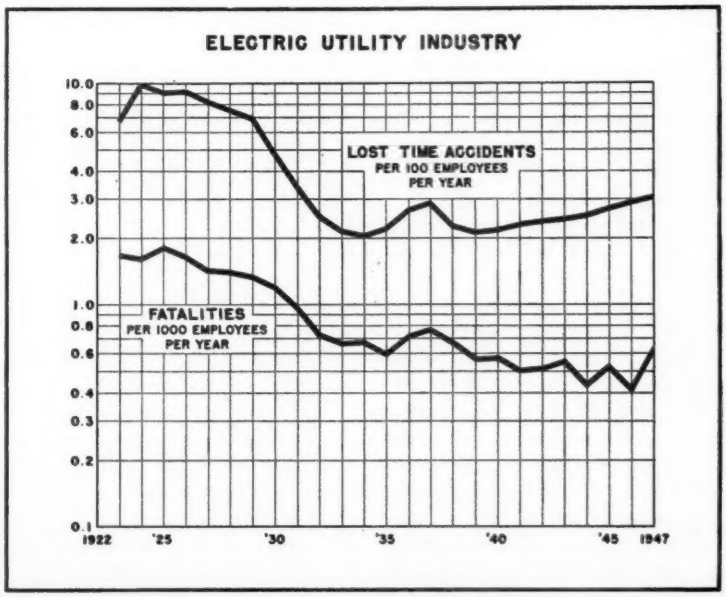


Fig. 1—Graphs of Lost Time Accidents Per 100 Employees and Fatalities Per 1000 Employees in the Electric Utility Industry, 1922-1947

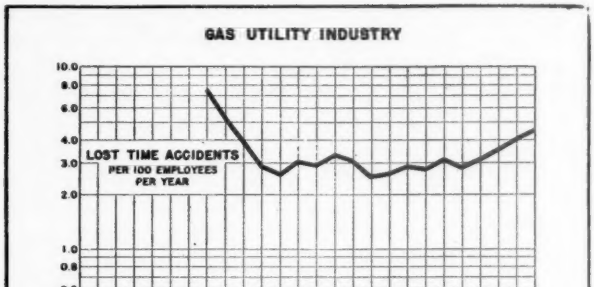


Fig. 2—Lost Time Accidents and Fatalities in the Gas Utility Industry, 1922-1947

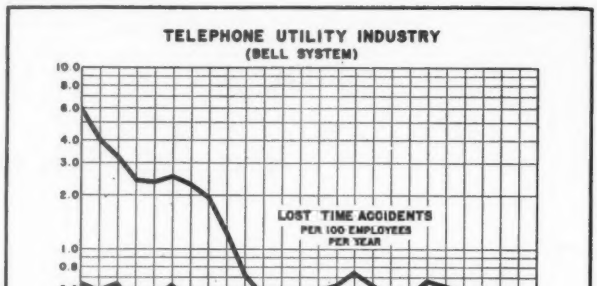


Fig. 3—Lost Time Accidents and Fatalities in the Telephone Industry (Bell System), 1922-1947

dropped rapidly between 1926 and 1933, less rapidly since then, but fairly steadily downwards until 1946.

The net result indicated by this fatal accident curve is a saving of about 300 lives *per year* in 1946 compared with 1926—a splendid record of saving in lives, but it still left over 100 Fatals per year to work on.

In 1947 something went wrong, Fatal accidents jumped from 108 to 173, an increase of 60 per cent. The Accident Prevention Committee of the Edison Electric Institute is busy trying to figure out what happened and I am sure if they diligently analyze the problem they will find the answer. What we want to make sure of is that 1947 is not indicative of a change of trend. That curve must be made to turn down, not up.

Looking back over the years and reviewing the safety work done, a number of items come to mind which have been helpful in bringing the accident record to its present level.

Improvements in design; safety activities on construction jobs; getting operating men interested in safety, as an *operating* problem; stressing of foreman responsibility; development of company rule books; increased use of rubber protective devices; company safety committees; organized safety departments; competitions on company, regional and national bases; increased committee activities on national and regional scales; increased executive interest and a somewhat greater feeling of responsibility for accidents; job analysis—practiced in recent years by some companies but still being done on a meager scale.

Great improvements have taken place in practices of grounding, holdoffs, use of rubber protection, etc. Improvements have been made in the design of structures and apparatus. We are now protecting lives through mechanical means to a degree not thought of 25 years ago. The August issue of *Electric Light and Power* carried a striking article on this subject by W. T. Rogers of Ebasco Services Incorporated which is well worth reading.

However, in spite of this progress in reducing Fatal accidents, the steady increase in Lost-Time accidents would lead us to believe that the electric utility industry has not been getting at the real *fundamental bases of accident prevention*. We have been coasting along, perhaps a little too satisfied with the results of our Fatal-accident prevention work, satisfied with even the slow rate of reduction in recent years, and not realizing that the Lost-Time curve was flagging us a warning. *Now* in 1947 the Fatals go up. How do we know we have not struck bottom there, as the other curve did in 1934? How do we know it is not going to turn definitely upwards?

What *are* the fundamental bases of industrial accident prevention?

1. Every position of *authority* in an organization carries with it the *responsibility* that goes with the job. To a large extent top management in the electric utilities have held their safety departments responsible for accident prevention when that responsibility is a function of the operating organization—headed up by the president and general manager. The duties of a safety director are those of a staff officer—to advise, inspect, coordinate, prepare and give impetus to plans. It is the duty of the line organization to carry out the plans.
2. A *safe* way can be found for every operation needed in our business. It is the duty of top management to see that the work is done the safe way. When I was a youngster I was told many times that "there is a *right* and a *wrong* way to do *everything*." That is true of every type of operation in our industry, but we have not begun to put down on paper *what the right ways are*, and follow this up by *seeing that each operation is done the right way*.

We can go just *so far* by the methods we have been using, together with all the inspirational efforts that tend to create a safety consciousness among employees, but as long as individuals are permitted to continue to use individual judgment on *methods of doing work*, especially in hazardous situations, I am afraid we may be on the up-grade in accidents of all kinds.

These remarks apply equally well to the gas industry. Take a look at Fig. 2, their Lost-Time and Fatal rates from 1929 to 1947, the period during which statistics have been made public. Note the similarity to the electric curves—the increase in Lost-Time accidents since 1932, particularly marked in the last four years; the lack of any improvement in the Fatal accident rate since 1933. *The*

Fatal rate in 1947 was actually higher than it was in 1933. Apparently the gas industry suffers from the same fundamental trouble as the electric; in fact, the trends are a little worse.

Now let us look at the telephone industry and see if they show the same trends. Fig. 3 shows the Lost-Time and Fatal rates for the years 1922-1947 inclusive for *male plant employees* in the Bell system operating companies. Note the similarity of the Lost-Time curve to that of the electric from 1922 to 1933, except that the telephone rate fell much more rapidly than the electric. But since 1941 there is an entirely different story. Whereas the electric and gas from that time show steady increases, the telephone curve has gone steadily down. The Fatal curve also shows a steady decreasing trend, but at a much lower level than the electric.

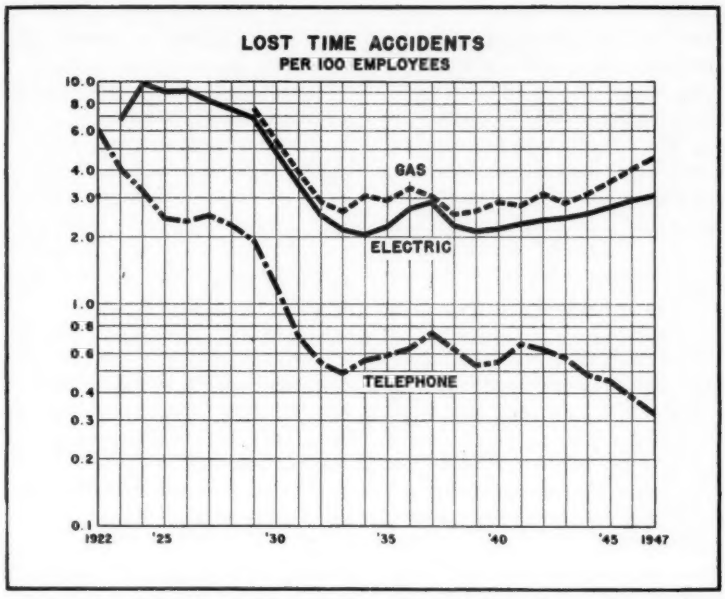


Fig. 4—Graphs of Lost Time Accidents Per 100 Employees for the Gas, Electric and Telephone Utilities, 1922-1947

"How Come?"

Now, let us look at comparative curves of Lost-Time accidents for all three industries on the same chart. Fig. 4 tells its own story and it provides a striking challenge to the electric and gas utilities. The telephone people had as many accidents as the electric had in 1922, but now look at them. Look at the trends since 1939—electric and gas going steadily *up* while the telephone keeps going *down*. I hope you electric and gas men will show a copy of that chart to the executives of your companies and to your safety committees and ask them, "HOW COME?"

True there may be greater hazards in the electric and gas industries than in the telephone industry tending to cause *Fatal* accidents, but when you eliminate electric shock cases from both the electric and telephone records you find that the electric have *more than twice* as many *Fatals* per thousand as the telephone. Telephone men are subject to fully as many hazards —such as falls from poles and ladders, automobile accidents, manhole explosions, drowning, etc., as the electric, yet, for those types of accidents they have more than twice as good a Fatal record. WHY?

At this point let me say that all these charts are *average figures*. Some telephone companies' results are substantially better than others. Some power and gas companies are also substantially better than others, and the better ones may compare favorably with the telephone figures.

Fig. 4 is a record of the general run of Lost-Time accidents such as slips and falls, automobile collisions, injuries from tools, falling objects, etc. I don't think electric and gas men are subject to any more of those types of hazard than the telephone men are, but their records are about ten to fourteen times as bad respectively. WHY?

Of course, all comparisons between industries are open to criticism just as they are between different companies. Perhaps there may be differences in the care taken to get men back to work to avoid reportable accidents. That occurs in many companies in all industries, especially when they are entered in safety contests. In any event, it can't have a great effect on a national scale. Remember the telephone record shown is for *male plant employees*. It is not diluted by counting the girls in the traffic department. The electric and gas figures are for *all* employees.

They Have It Here!

What do the telephone people do that the others are failing to do to make such a record? It must be *something*. Records like that do not occur by chance.

You remember how the girls are supposed to have written during the war to their boy friends overseas—"What have those foreign girls got that we don't have?" The answer was — "Nothing dear, but they have it here!" Well, I'm not so sure that the telephone fellows do not have something that the others do not have, and they have it here.

There must be some reason for the fact that the Communications Industry as a whole leads *all* industries in the tabulations of frequency and severity published by the National Safety Council.

For one thing, the Bell companies have centralized supervision and standardized practices. Because of this they can obtain much greater uniformity in safe practices than either of the other utilities. In the Bell system a line truck and a service wagon in Maine are equipped exactly like their counterparts in Florida or Texas. They have job analysis worked out to a fine point—there is a right and wrong way to do everything and they teach their men the *right* way—*one* right way which is adopted as a standard throughout the country.

A second feature of Bell Telephone operation is their Training Courses for supervisors. These are operating courses, primarily designed to teach men to do their operating and maintenance work most efficiently. They have developed into Safety Courses. By teaching men the *right* way they teach them the *safe* way. These courses comprise:

A. *Vocational Instructor Training,* in which supervisors are taught how to teach their men. We all know that the best way to learn a subject thoroughly is to teach it to somebody else.

B. *Human Relations,* in which supervisors are taught how to win and maintain the cooperation of their men on the job.

C. *Planning Supervisory Jobs,* in

which the supervisors are taught how to plan their work and carry out their supervisory responsibilities.

A third feature of Bell Telephone operations, which again stems from centralized supervision, is executive interest in accident prevention. When a head office, such as the A. T. & T. headquarters in New York, is thoroughly sold on safety, it can have a great effect on the interest which is maintained by executives in subsidiary companies.

The telephone industry is quite capable of telling the world how good it is without my help, and how well they do it! But electric and gas men are trying to solve our problem, which we have seen to be getting worse instead of better, and we should take full advantage of what our telephone brethren are doing and see to what extent we can use their ideas, and work toward their results.

Cooperation of the Utilities

Many good ideas in safety, developed by companies of the electric, gas and telephone utilities, have been exchanged and adopted by other companies in these industries. Since the problems of all three utilities are identical we may look forward to further improvements by continuing such cooperative methods.

Since the passage of the Holding Company Act of 1935, the electric and gas industries corporately have been almost completely disintegrated. We have lost whatever centralized supervision we had, and can never recover the benefits that flow from unified direction and control. We can, however, make full use of all the ideas we can pick up at this Congress, and put them to work in our own companies when we go back home.

We have now reviewed the record of the past 25 years. We have seen that we are in a serious position in the electric and gas utilities, with accident frequency steadily increasing and with severity rates at a standstill, or on the upgrade. We have also seen that this condition *"ain't necessarily so,"* for a sister industry that has just as many potential hazards, except, perhaps, for electrical shock, is able to operate with one-tenth as many accidents.

What, then, are we to do to reverse the trend and pull those curves *down?* They are certainly not going to turn down of their own accord. The natural trend is bound to be *up.*

We must remember that 25 years ago life was a lot less exacting than it is today; the pace was slower; automobiles were much slower in speed, and less powerful—much less plentiful.

There were no transcontinental airways, no national broadcasting, no sound movies, no sound trucks, and no television. Life was comparatively quiet. Now we have reached the atomic age. Our nerves, shattered by two world wars, have to run a daily barrage of jarring impacts, including the fears of World War III.

Our bodies and our mental processes are very much as they were hundreds of years ago, but due to the speed-up of our type of living they have to withstand shocks day after day for which nature has not equipped them. Little wonder that 50 per cent of our hospital beds are filled with mental cases, and one marriage out of three is ending in the divorce courts. This airplane — television — atomic age has made us a nation of neurotics, and today the great cry among the medical profession is for more psychiatrists to keep us all from ending up in mental hospitals.

Now where is this all going to lead to in the NEXT TWENTY-FIVE YEARS? There does not appear to be much chance of slowing down our activities. This year our air force has announced with great pride that planes have been built which fly faster than sound. Where do we go from here? To greater and still greater speed? Life has indeed become a war of nerves.

This is not the place to spend our time speculating on where the world is heading, but we can do some serious thinking about the effect of the increased pace of living on our accident trends. What to do about those accident curves? What can we do to head off the rising record of accidents that faces us in this speed-crazy atomic age? From the trend of those curves it is apparent that unless we make some fundamental changes in our methods, it is going to be difficult to even hold the present line, let alone show any improvement.

Mechanical Improvements

It is fair to assume that what may be called mechanical improvements, which are found in our best operated companies today, will become more generally used. These include improved design, interlocks and all sorts of equipment and devices which can be used to make operations safer. A number of years ago it was difficult to make a worker use goggles, and even ten years ago many companies did not compel electrical workers to wear rubber gloves when handling 2,300 volts hot. Surely those are standard practices today. Or are they? Even the safety engineers of our industry have not agreed on a standard practice as to *where* a lineman should put on his rubber gloves!—at the foot of the pole or within four feet of the energized conductors? Surely we have had enough accidents so that we can determine what the safe practice for such a simple operation is—what the *right* way is.

What then must we in the electric and gas industries do to turn those curves down?

Executive Interest

First and foremost in importance is the matter of *executive interest.* While I have never yet seen an operating company president who did not *say* he was interested in accident prevention, I have met comparatively *few* who *actually work at it.* Many executives make a speech at the annual safety banquet, hand out a few diplomas to first-aid teams, then settle back and let the safety director and the safety committees look after the actual work for another twelve months. They may call in their top men when some exceptionally bad accident has occurred, perhaps several men killed—raise hell all around and say—"This sort of thing has to stop!"—but then become immersed in operating details and do little or nothing until the next time. We speak of "executive interest" in accident prevention as if it were something the safety director should plead for. Safety men of the industry frequently act as if they look upon accident prevention as *their* responsibility, and they ask for cooperation from top management, instead of trying to show that management where *their* duty lies and pointing out what *they* (the executives) should do about it. Many of you no doubt read the address of Mr. A. T. O'Neill, President of the Buffalo Niagara Electric Corporation, given before the EEI Convention at Atlantic City last June. (EEI BULLETIN, June, 1948, p. 207.) Here is a chief executive who really works at accident prevention, not just once a year but *every day in the year.* The result of his efforts is shown in Fig. 5, which was copied from one used by Mr. O'Neill. Compare his company's results with those of the whole electric utility industry. The average Fatal accident ratio for the past nine years is less than 0.2 per 1,000 employees, against an industry average of over 0.5.

This is one of the most outstanding examples I know of where executive action has sparkplugged such excellent results. There may be other electric companies with equally good or better records but if so their chief executives have not called attention to them.

Executive Responsibility

Here we have an outstanding executive of the electrical utility industry addressing fellow presidents and general managers, pointing out their duty to them. I quote from his address—

"There is no substitute for sustained active participation by the heads of the organization. If we want a safe organization badly enough, then we ought to be able to keep at it on a day-by-day basis. There is a chain of responsibility that binds you and me closer than is comfortable to these deaths and injuries, if we are to face the issues squarely."

There Mr. O'Neill laid it on the line —executive responsibility for deaths and injuries in the industry. He pointed out that the Fatal rate had gone up over 50 per cent in 1947. I wonder how many of the executives who heard his address were stirred to action by that knowledge? I wonder how many safety directors called the attention of their top management to that address and, incidentally, the responsibility to which it referred?

Job Analysis

Next in importance in our "things to do" is to develop *Job Analysis* on a major scale. Safety men talk about it as "On-the-Job Safety" but we all know that safety should start *before the job.* We should have handbooks of instructions on every type of work, and should discuss the hazards of each job before it is tackled. Too many men have gone to their death because the foreman said "Let's go, boys" without explaining in detail how the job was to be done, or checking up to see if he or his men understood what the hazards were. Job analysis is a major job for operating men. As an example of the extent to which job analysis can be developed, the Bell system has a 35-page pamphlet on Extension Ladders. Imagine, 35 pages describing ladders and their proper use, safety precautions, inspection and care. That seems like a lot of details to put out about *ladders,* but just remember those accident figures—one-tenth of the electric, one-fourteenth of the gas. *It pays off,* and *pays off big!*

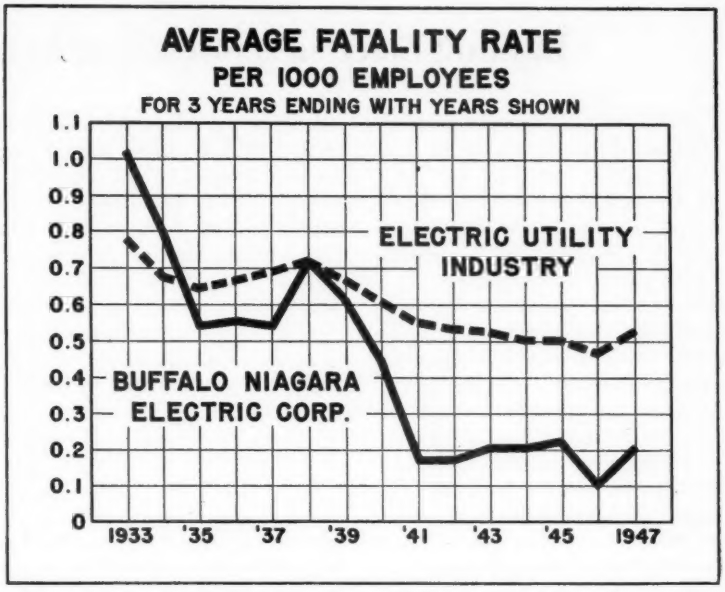


Fig. 5—Graphs of the Average Fatality Rate Per 1000 Employees for Buffalo Niagara Electric Corp. and the Whole Electric Utility Industry, 1933-1947

Training Programs

The third big job in the years ahead is for all companies to develop sound *Training Programs.* Many of our companies have schools for linemen where apprentices learn the rudiments of distribution work. Some companies have Training Classes for foremen. But industry wide, our Training Program is in a primitive state. We have seen how in the Bell System they emphasize foreman training and develop their foremen into teachers and leaders of men. Can we do better than study their methods, and then go and do likewise?

We have always had a lot to *say* about the foreman in accident prevention work. We have laid heavy responsibility on him, and have expected a great deal from him, frequently without too much backing from those in authority above him. We expect him to have remarkable qualities of leadership and yet do comparatively little to develop them.

The qualities of leadership which make a good foreman are hard to describe, but they may perhaps be best grouped under the word "personality." A *good* foreman in every sense of the word is a *real person.* We all know the "tough guy" type of foreman who can only show his authority by barking orders and bawling out his subordinates. We want none of that type in our industry today. We need leadership in its highest sense, and a foreman who would be a real leader must not only know the technical details of his work, but must also be both a student of human nature and a natural psychologist. He must be able to analyze his men and understand their moods, and in this neurotic world most of us have our moods, our fears and our phobias.

How often have we seen accidents occur for which there seemed no possible reason—frequently to some worker who is known for his interest in safety. How many of those accidents were caused by blackouts due to emotional upsets we shall never know, but I venture to say there are many of them. We are learning a good deal nowadays about the mental conflicts that entirely normal people frequently go through—caused by unhappiness at home, feeling of a lack of security, or perhaps some deep-seated neurosis acquired in youth. While we cannot expect our foremen to be able to get to the bottom of these neuroses, that being the job of a psychologist or a psychiatrist, they should learn to know them when they see them. They should understand the emotions of their men and be close enough to them *to know when they should not be allowed to work in hazardous positions.* No man undergoing the stress of a mental conflict should be permitted to work on hot lines or hot structures.

While utilities may not require so much psychological attention as many other industries, particularly those with

(*Continued on page* 422)

Indiana Electric Association Annual Convention

AT THE Annual Convention of the Indiana Electric Association held at French Lick, Ind., on Oct. 13, 14 and 15, papers and talks of direct and indirect interest to the electric utility industry were presented by speakers from many parts of the country.

President C. K. Graham in his opening remarks called attention to the publicity given to the present tight generating capacity situation. He expressed the opinion that the operators of electric companies will use all available resources to avoid restrictions on the use of electric power for any purpose. He also suggested that it might be desirable for the industry to engage in selective promotion activities where additional or new equipment will not have the effect of increasing existing maximum demands.

A. C. Crandall, vice president of the Indianapolis Power and Light Co. reviewed the progress being made in developing the heat pump. He advised the delegates that much research and future development will be necessary before this form of heating is generally available for use by the consuming public.

Community Welfare Development

A. C. Spurr, President of the Monongahela Power Co. reviewed the activities in his area in developing community welfare. He called attention to the necessity of representatives of the electric industry doing everything possible to promote the prosperity of the areas served since communities and customers must prosper first before our industry can do likewise.

Edwin Vennard, vice president of the Middle West Service Co. presented an illustrated talk under the subject, "Rising Costs and Electric Rates." He pointed out that costs of commodities are still on an upward trend, and until recently, the cost of electric service has still been going down.

Ernest R. Acker, President of the EEI and President of the Central Hudson Gas & Electric Corp. reviewed the action taken to oppose increased appropriations for a steam plant in the TVA area. Attention was called to the continued attempts to socialize the electric industry on a national scale.

Various important problems facing the industry were emphasized by Dr. Adam S. Bennion, vice president of the Utah Power & Light Co. at the last business session of the Convention. He pointed out the importance of the adequate supply of electric power, properly trained young men in the industry and guarding the industry against possible socialization.

Other speakers participating in the program included Leroy E. Yoder, Chairman of the Public Service Commission of Indiana; Theodore R. Sills, Theodore R. Sills and Co.; D. W. Michener, Chase National Bank; Clayton Rand, Editor of *The Dixie Press,* Gulfport, Miss.; and Nathan Howard Gist, New York.

G. J. Oglebay, vice president of the Public Service Co. of Indiana, Inc. was elected President of the Association to serve during the coming year and E. F. Hauser was elected Secretary-treasurer.

Ebasco Holds 10th Annual Safety Meeting at National Safety Congress

REPRESENTATIVES of 32 client companies and guests of Ebasco Services Incorporated attended the 10th Annual Ebasco Safety Meeting held in Chicago, Oct. 18 and 20, in conjunction with the National Safety Congress. Representatives of electric, gas and transportation companies in the United States, Canada and Cuba discussed mutual problems in the two-day session. The delegates comprising operating executives and supervisors in addition to personnel, insurance, claims and safety officials exchanged views and studied ways and means of reducing accidents in their respective operations.

The principal theme of the meeting was a detailed presentation of "The Essentials of a Successful Accident Prevention Program." W. H. Senyard, Director of Personnel, Louisiana Power & Light Co. conducted this phase of the program. The first subject under this theme was presented by C. J. Rutland, Texas Power & Light Company who spoke on "Safety Organization."

The second part, "Methods of Application" was presented by T. O. Perrault, Minnesota Power & Light Co. The third subject, "Tools and Techniques" was presented by J. O. Speed, Birmingham Electric Co. C. E. Hammon, Columbus and Southern Ohio Electric Co. led the ensuing discussion and summarized the thoughts of this presentation. A presentation and discussion of Safe Driver Training was made by C. L. Hightower, United Gas Pipe Line Co.

A half-day session was devoted to a Problem Forum conducted by J. M. Hinds, Mississippi Power & Light Co. assisted by O. S. Hockaday, Texas Electric Service Co.

At the Ebasco luncheon held on Oct. 20, H. H. Scaff, vice president of Ebasco Services Inc. announced the standings in the newly inaugurated Ebasco Safety Award Program. K. M. Robinson, President of The Washington Water Power Co. was principal speaker at the luncheon. His topic was "Safety from Management's Viewpoint." Mr. Robinson spoke of the great benefits the electric utility industry has reaped since the value of organized safety programs was recognized. He pointed, however, to the alarming increases in injuries and fatalities over the past 15 years and suggested that the trends are due to management's lack of participation in the safety program. Top-level management has been too preoccupied with organization matters, financing, labor problems and power shortages and has not given sufficient attention to accident prevention but left the safety program entirely in the hands of the safety directors.

K. R. MacKinnon, President, Ebasco International Corp. commented briefly on Mr. Robinson's talk and gave some interesting information about Mr. Robinson's career in the utility industry. The luncheon meeting was concluded by the general chairman, W. T. Rogers, Safety Consultant of Ebasco who remarked that those directly responsible for safety activities in their companies should be greatly encouraged by the keen interest in safety manifested by the presence of the top executives who took time away from other pressing duties to participate in this client company safety program. The meetings were held under sponsorship of Ebasco Insurance Department, I. M. Carpenter, Manager.

The Human Side of Other People

By Horace I. Seeley
Chief Accountant, Carolina Power & Light Company

An address before the Accounting Conference of the Southeastern Electric Exchange, Raleigh, N. C., October 29, 1948

THE thing in this world about which we know the least and talk the most is other people. Talking about other people is sometimes called the second most popular topic of conversation; the most interesting and by far the most popular, of course, is talking about ourselves.

We often hear two seemingly contradictory statements; the first, that it takes all kinds of people to make a world; the second, that human nature never changes. Is this paradox true? Is everybody different, and yet the same? Is there an unchanging human side of people which underlies their acquired characteristics?

In this tricky area few facts have been established. Yet if the saying that human nature never changes is true, that what's bred-in-the-bone-must-tell, that people have a common inheritance from thousands of years of evolution—then people should run true to form in many of their actions. And so they do! All people seem to want the same things! Their motivation drives are about the same!

Human Race Is Complex

Of course the human race is complex and it is held together by complex relationships. Nothing anyone can say will change this fact. People may be created free and equal, but the equality part stops there. The philosopher, Locke, contended that people are born with blank minds. I can confirm this, and I am not a little proud that I have held my own thus far. One thing is certain: from the day a baby learns he can get attention by yelling, he starts developing methods to get through life the easy-payment way. He avoids pain: he seeks comfort and recognition. He acquires a behavior pattern designed to get the good things of life with the least conflict. The end result is a person conditioned to his environment, quite unequal and quite different from anyone else. Some are aggressive, others timid; some are strong; others weaklings; some are able to express themselves readily, others are inarticulate; some have ability but little ambition or drive, others have plenty of ambition but little ability; some get along well with other people, others never make this grade; and finally some are nice people to know while others are crackpots or human gorillas from whom the rest of us want nothing at all but distance.

Yet underlying these largely acquired traits, people are the heirs of human nature which never changes. Man or woman, rich or poor—white collar, blue collar or no collar—people run true to form in their motivation drives and in the things they want. At least, I so believe.

Success and Other People

When we were very young, you and I, we started out with the idea we would be the sole architect of our personal design for living. We sang in our bathtubs, "I am the Captain of My Soul!" It seemed very reasonable, when we were young, that in the days to come we should mold our business careers and fortunes upon the sturdy virtues of honesty, hard work and keeping our ears cocked for opportunity's knock. But after a few years of conditioning, most of us awake to the realization that success in the social and business world depends largely on other people. It's what other people think about us, and what they say about us, and what they do about us that counts. Some of us learn this the hard way, some still think it isn't true and blame their failures on circumstances, but a lucky few come to the conclusion early in life that getting along with other people is important and proceed to do something about it. As a rule they are successful men and women.

A monthly pocket magazine recently reported on a questionnaire sent to a representative group of successful people. Among the questions asked was, "What single ability is most essential to success?" The answers came back almost unanimous: "The single ability most essential to success is the ability to get along with other people!" Only a few years ago, I am inclined to believe, the answer to that question would have been different. Education and preparedness might have been stressed, and hard work and thrift, and maybe marrying the Boss' daughter, though scientific management has decided that the man who marries the Boss' daughter to get ahead should love one of two things a lot, either the job or the girl. But, today, refinements in business organization have brought a condition where few men do their jobs by themselves or for themselves. Human relations is the most important aspect of your working hours.

This is the reason the great bulk of management's problems, and most of our individual problems, lie in the field of human relations. It explains why writers and speakers on this subject, and I quote at random, say *"human beings* are the most important consideration in this world; it is the *person* who does the job, operates the machine, manages the organization; we come at long last to *man,* the most amazing, interesting and intricate, as well as the most highly potential machine of all!"

Reconciling Production to People

We know that today management's biggest problem, and our problem in the chain of management, is to reconcile the ever-increasing and exacting demands of production efficiency with the drives and hopes, the desires and aims, and the interests and wills of people.

Because it is quite impossible to broaden the field in a narrative of this dimension, I shall confine my remarks to some observations about the human side of other people, and leave to others more competent the overall problem of bettering human relations up, down and across the board in the business organizations we represent.

I should be less than frank and more stupid than usual if I pretended to be an expert in human relations. I am not a trained psychologist. I'm just a simple, ignorant fellow who likes all kinds of people as soon as I get to know them well.

It is really remarkable that we know

so little about the principles of getting along with people. Despite the fact that we are graded continually on this accomplishment, it still isn't taught in our schools. And usually it isn't taught in business, though we have basic training and manuals and check-lists for less important things. Even the most popular book on the subject, Dale Carnegie's "How to Win Friends and Influence People," gives no magic formula. It's a good book to read and re-read. Yet the meat of this book, and others of like content, boils down to two good pieces of advice: you must make your attitude conform to the demands of other people's human nature; and you don't find friends, you make friends!

There are three generally recognized attitudes we can take toward the problem of human relations.

"It's My Life . . ."

One to the far-left, not highly recommended because it is a negative attitude, is to the effect that "it's my life, I live it and I love it, to hell with other people."

A middle way, followed by the great majority, is the passive attitude that human relations is strictly a two-way street. "I stand ready," many say, "to meet the other fellow half way, but I'm not going to carry his share of the load. I'm not buying any part of becoming an apple-polisher or man-pleaser. Not me! If people want good relations with me, let them show it and I'll do my part." I believe this attitude is largely responsible for the status quo with which none of us are satisfied. It's a reasonable position, no doubt, this thing of insisting human relations is a two-way street, but it isn't pointed to win friends readily, and it doesn't influence many people favorably.

There remains a third attitude we can take: let's say it is to the far right, which sounds as though it were a good direction to be heading. It is an aggressive attitude and it is a questioning attitude. It asks why, when I am filled with a lot of muddled good-will towards everybody, do I rub people's fur the wrong way? Some people seem to have a knack for saying the right thing while I frequently say the wrong thing; what do they know about people that I don't? Can I learn how to make friends? Yet as individuals our relations with people are primarily a problem involving only two persons. Just as the animals went into the ark two by two, the hippopotamus and the kangaroo, we still do business two by two.

We know a problem can be solved if it can be broken into its component parts. What are the things that all people seem to want? What is this common heritage called motivation drives which impels us to action? Let's count the bones in this horse.

There has been a lot of over-simplification about people and the things which make people click. One fellow says everybody acts from motives of either fear or greed. Another says people are like jackasses, they must have both a carrot and a stick. Still another man, and this fellow is a big-shot electrical manufacturer who pioneers profit-sharing, says "I run my business on the principle that everybody is essentially selfish; about the best I can hope for is intelligent selfishness." Some ask the words be changed to enlightened self-interest which sounds better than other kinds of selfishness.

There is some truth in all this. But it is over-simplified. You simply cannot tie human nature down with a few words. The "fear-greed," "stick-carrot" and "essentially-selfish" definitions of human motivation drives leave out such things as loyalty, and initiative, and enthusiasm. It discounts the devotion of hearts and minds to the things people believe in, and it completely overlooks the motive of keeping up with the Joneses, which you will agree makes us all jump high and stretch far. It's human nature to want things, to be sure! It is also human nature to give as well as get, to worry about the welfare of others, and to want our children to have it better than we did. These things are bred in the bone. There are other motivation drives; several that I could name, but I am speaking primarily about those which affect interpersonal relations.

One-Value Judgments

Psychologists agree people are whole persons psychologically just as they are whole persons physically. This means, as I understand it, it's snap-judgment to say or believe "Tom is after nothing but money," or "Dick is a sour-belly," or "Harry is simply over-sensitive." It's a mistake to catalog anybody as a one-characteristic person. The chances are overwhelming that Tom and Dick and Harry have a complete set of motivation drives. Very likely Adam had 'em!

Of course different psychologists have different names for these drives. But the area of agreement is growing. They are generally agreed that people want to feel important; they want recognition. People need to be needed; to be on the team, to be consulted and informed and praised and trusted and respected. It makes them feel important. Charles J. Stilwell, president of Warner & Swasey, the concern which is doing an outstanding "free enterprise" institutional advertising job, in an address to the National Association of Manufacturers last December said, "We haven't had time to be human in our relations with our employee partners . . . we have failed to give our men the sense of importance which is the greatest driving force in the world. . . . Because of our failure, they have looked for it and found it elsewhere—on Union Committees, in anti-business lecture halls, yes, on the picket lines."

Justice, Pride and Rivalry

And psychologists teach that people have a sense of personal outrage about the things they consider unfair treatment; they want impartial treatment; they want credit where it is due. Lots of our human impulses stem from the demand that things be put right. Patriotism and the willingness to fight for the things we believe in lie in this area. Some people think that opportunity to better their condition in life is a matter of justice.

And, of course, no thinking man denies that people want the best rewards obtainable for their work. They want higher wages and better living standards. Pride of accomplishment is also a recognized motivation and in itself a reward. Rivalry is a motivation drive; the desire to excel at something. Another is the desire for a new experience—to see the big elephant, and Georgia Tech's football team, and the other fellow's hole card.

It occurs to me, however, these components of human motivation drives support the original proposition that human nature never changes. The only simplification I dare to make is that we still do business two by two. This is the premise which offers an opportunity to develop a few simple principles in our search for ways to get along with people better. If we fail with one person, we may do better with the next. And, gradually, if we succeed with one person after another, it becomes easier to do the things which help to make for good human relations.

Every contact we have with another person is important. Our attitude, the

things we say or write in a letter, the things we do as well as the things we refrain from doing, all are being weighed. When we look back to a particular time we made a fool of ourself, we can often recall just when and how it happened. I have talked with a man and knew I was rubbing his fur the wrong way when there was no point in doing it. I wouldn't shut my mouth or change my attitude. I forgot to remember. I forgot the things we all know about other people. I have been impatient, rude, impudent, arrogant, stubborn, contentious, cruel and all the other bad things, when every bit of common sense I have told me to behave differently. Have you had such experiences?

Remember People

I have had the consciousness of being a fool so many times, I made for my personal use a check-list of things to do and not to do when I talk to a person. It is a simple list, based on observations built around the fact that people need to feel important. This string-around-the-finger that I keep in my desk may not be things you forget to remember, but I confide it is helpful to me because I find that nearly every time I come away from a meeting with the feeling things haven't gone well, I have violated one or more of the things I must continually caution myself to bear in mind.

Here's the list:

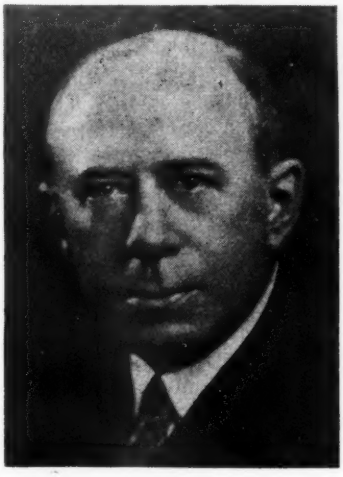
1. *Remember* people like to talk about their achievements and their disappointments! Evidence a genuine interest in the things a person hopes and expects to do.
2. *Remember* people like to be encouraged! Practice the development of a positive attitude toward life's problems. Don't be known as a person who sees lots of trouble.
3. *Remember* people like to be consulted! Ask for their opinion and for their help. Assume every man knows more about his specialty than you do, and be sure he knows you believe this to be true.
4. *Remember* people like to be respected! Be careful to accord every person the full title and the full respect due his position. Nobody lightly forgives one who underrates them.
5. *Remember* people like a choice! When you try to sell an idea, present an alternate even though it may be directed to the same objective. When a person is allowed to make a choice, he has a stake in the proposition.
6. *Remember* people act abnormally under censure! Embarrassment is a great hate producer. Make allowances for a fellow in a tight place; help him to save face, and cover for him if you can properly do so.
7. *Remember* people like to be remembered! A sure way to a person's good regard is to quote exactly something he said or did and comment on it favorably. The converse is likewise true; to forget a name or an occasion you should remember is inconsiderate.
8. *Remember* people like praise but they do not like flattery! Be sincere. Praise the deed or the motive.

That's my check-list, built around things I should remember when I talk with other people. I am convinced that a person can improve his human relations if he will but realize, as Shakespeare said, "The fault, dear Brutus, is not in our stars, but in ourselves . . ."

White collar, blue collar or no collar —we're pretty much the same, you and I. Complex, but we are whole persons psychologically. Unequal in our abilities and accomplishments, but similar in our motivaton drives and human nature. Illogical and impulsive and often unreasonable, but responsive to praise and recognition. It's our human side, yours and mine.

Arthur C. Watt

ARTHUR C. WATT, an executive assistant of Commonwealth & Southern Corp., died Nov. 21 at his home at Scarsdale, N. Y., after a long illness. His age was 62.



MR. WATT

Born in Chicago, Mr. Watt started his career in the general freight department of the Rock Island Railroad offices in Chicago. He came to New York to join the brokerage firm of Jones & Baker. In 1918-1919 he was on the staff of the *Magazine of Wall Street*. In late 1920 he became security analyst for the firm of Hodenpyl & Hardy, an investment banking firm which developed public utility properties in Ohio, Michigan and Pennsylvania.

Mr. Watt played an active part in the program which resulted in the combination of these properties into the Commonwealth Power Corporation. This concern was the nucleus of the Commonwealth & Southern Corporation formed in 1929, and of which the late Wendell Willkie was president for several years.

In his work in the public utility field, Mr. Watt made notable contributions to the advertising and public relations activities of the electric and gas industries through his association with several national organizations.

In the 1920's he was a member of the Advertising and Public Relations Committee and the Employees Information Committee of the National Electric Light Association. In more recent years he had served as a member of the Management and the Copy Groups of the Electric Companies' Advertising Program, and as a member of the Edison Electric Institute.

For many years Mr. Watt was also a member of the Publicity and Advertising Committee of the American Gas Association.

Few there were who had a broader vision of the great part the electric and gas industries played in our national life, and, because of his unique memory of all their aspects, he was a special source of information to those who constantly sought his advice.—C. E. N.

Nation-wide Observance of Edison's Birthday Is Planned

THE Edison's Birthday Committee, in collaboration with the Thomas Alva Edison Foundation, is directing plans for the annual national observance of Feb. 11, the inventor's birthday, as Edison Day.

The emphasis of this program is placed upon community recognition of Edison's contributions to the scientific and industrial progress of the community and of the nation as a whole. Service clubs throughout the country have indicated their interest in planning special Edison Day programs—these include Rotary, Lions, Kiwanis and Civitan. A feature article by Frank M. Tait, chairman of the board, Dayton (Ohio) Power and Light Company, will appear in the February issue of *Civitan* magazine. The U. S. Chamber of Commerce plans to advise local Chambers of the opportunity to participate in Edison Day.

Interested industries and businesses have been contacted and a number of them are planning special advertising and public relations tie-ins. Several of them plan to use an Edison theme in their plant-city community relations campaigns while others will have open house for the community. General Electric plans to take 4000 school children through its Nela Park laboratories the week of Feb. 11.

Radio will also play an important part in the observance—the Voice of Firestone on Feb. 7 will be an Edison tribute and several other national network programs are planning to participate in observing Edison Day. Local radio will be represented by the programs of utility companies.

A typical Edison story will appear in *Nation's Heritage* which will carry a 15-page Edison picture feature. This publication will be available about Jan. 15.

Special sermon material will be sent to ministers throughout the country—Dr. Norman Vincent Peale has prepared the Protestant sermon and Rabbi Robert Rosenblum, the Jewish sermon. The National Catholic Welfare Conference has before it suggested material for dissemination to the Catholic clergy but this still is not definite.

The Governors of the states have been asked to proclaim Feb. 11 as Edison Day in their states. The Mayors of the various towns with a special interest in Edison will also be asked to proclaim Edison Day.

Electrical Leagues and several other trade associations have indicated that they will want to participate in Edison Day. Such special media as the Reddy Kilowatt and Metro-Mat services will offer their subscribers Edison features. Reddy Kilowatt also has a supply of the Edison story in comic book form available.

Public utility and other interested groups may obtain an Edison biography, suggested text for a speech, a community planning guide, service club program guide and an Edison chronology from the Edison's Birthday Committee, 10 Downing Street, New York 14. The Committee also has a supply of glossy prints of Edison portraits and work scenes which will be furnished free upon request; subjects desired should be indicated so that requests may be filled to best advantage.

Conversion of Milk Cooler to Heat Pump

A DESCRIPTION of the conversion of a milk cooler to a heat pump highlighted a paper on the engineering features of milk house heating presented by Marvin Nabben and Charles P. Wagner of the Agricultural Engineering Department, Northern States Power Company, before the American Society of Agricultural Engineers on Dec. 13, in Chicago, Ill.

Good milk houses, well insulated with infiltration reduced to a minimum can be heated by ¾ of a kwhr per degree day when the milk house is 1000 to 1150 cu ft. The heat is direct radiation from fan-type electric heaters.

The most striking part of the engineering paper is the description of the conversion to a heat pump of the milk cooler already available on many farms. Placing a solenoid valve on the incoming water line for the milk cooler and connecting a room thermostat to the solenoid valve is the simple step required. The amount of water flowing into the milk cooler must be regulated so that the amount of heat to be removed will not exceed the capacity of the refrigerating unit. This precaution is necessary to protect the milk already in the cooler.

When the room thermostat starts the flow of water the ice bank will melt, starting the compressor unit. In order to get best control they keep feed water away from the vicinity of refrigerator thermostat.

Since the water surrounding the ice bank may be about 35 degrees, the incoming water at a ground temperature of 45 degrees or more may give off some 10 degrees of its temperature. A 10-degree drop in water temperature at 1 gpm will result in release of about 4800 Btu per hour. The milk cooler refrigerator compressor of ¾ hp or larger would more than handle this output, therefore, not endangering the milk temperature. To arrive at the Btu output of the heat pump, the Btu removed from the water must be added to the Btu content of the power input to the motor.

Assuming a co-efficient of conversion on the milk cooler as being only 3 and assuming ¾ kwhr per degree per day for direct heat, then the milk cooler can heat the same milk house for 1/3 of ¾ kwhr or ¼ kwhr per degree day. This ¼ kwhr includes energy used to cool the milk. Actually the co-efficient of performance may be 3.75 or more on some part of this work.

Water pumping costs may be 20 cents to 30 cents per month depending on depth of well and electric rate. Cost of the solenoid valve will be about $10 and the thermostat about $12.50.

The engineers having recommended heating to 40 degrees only for economy, propose the use of infra-red heating for personal comfort. The dairyman is in the milk house only a short time. Heat from infra-red rays gives instant personal comfort without raising room temperature and increasing costs. The comfort heating proposal comes from heat or drying lamps operating to give off infra-red heat rays. Four 250-watt lamps are recommended to be installed in utensil washing area.

One feature of the paper is a degree-days table for 40 and 50 degree heating showing the greatly increased cost of heating at the higher temperature when 40 degrees satisfies the protection requirement.

This research work will be continued by a direct application program.

Welded Aluminum Bus in Outdoor Transformer Yard of Sewaren Generating Station

By D. M. Quick

Public Service Electric & Gas Company, Newark, New Jersey

A paper presented before the Electrical Equipment Committee Meeting, EEI, Pittsburgh, Pa., Oct. 15, 1948.

THE design of Sewaren Generating Station is based upon the unit system; boiler, generator, transformer and line. It consists of three 100,000-kw steam turbine-generator units now being installed with the fourth unit scheduled for installation in 1951.

The main leads of each generator consist of 525-ft run of oilostatic cable to the outdoor transformer yard. From the cable potheads until it leaves the station, except for the equipment such as reactors, transformers, disconnecting switches and flexible braids, current is carried by aluminum conductors. Fig. 1 is a simple one-line diagram which shows where the aluminum bus is used and the current carrying capacity for which each section is designed.

The buses used in the outdoor 13-kv Transformer Yard at Sewaren Generating Station are all designed to withstand a short circuit current of 66,000 amperes and are divided into three classes; 5,000-ampere, 4,000-ampere, and 3,000-ampere capacities. At the time the engineering was done on this work there was no difference in the promised delivery between copper and aluminum so that, with equivalent electrical requirements fulfilled, the choice of materials was based entirely on the cost of the ultimate installation.

The extensive use of aluminum bus requiring numerous taps and connections may have been debatable before the advent of Heliarc welding. As far back as

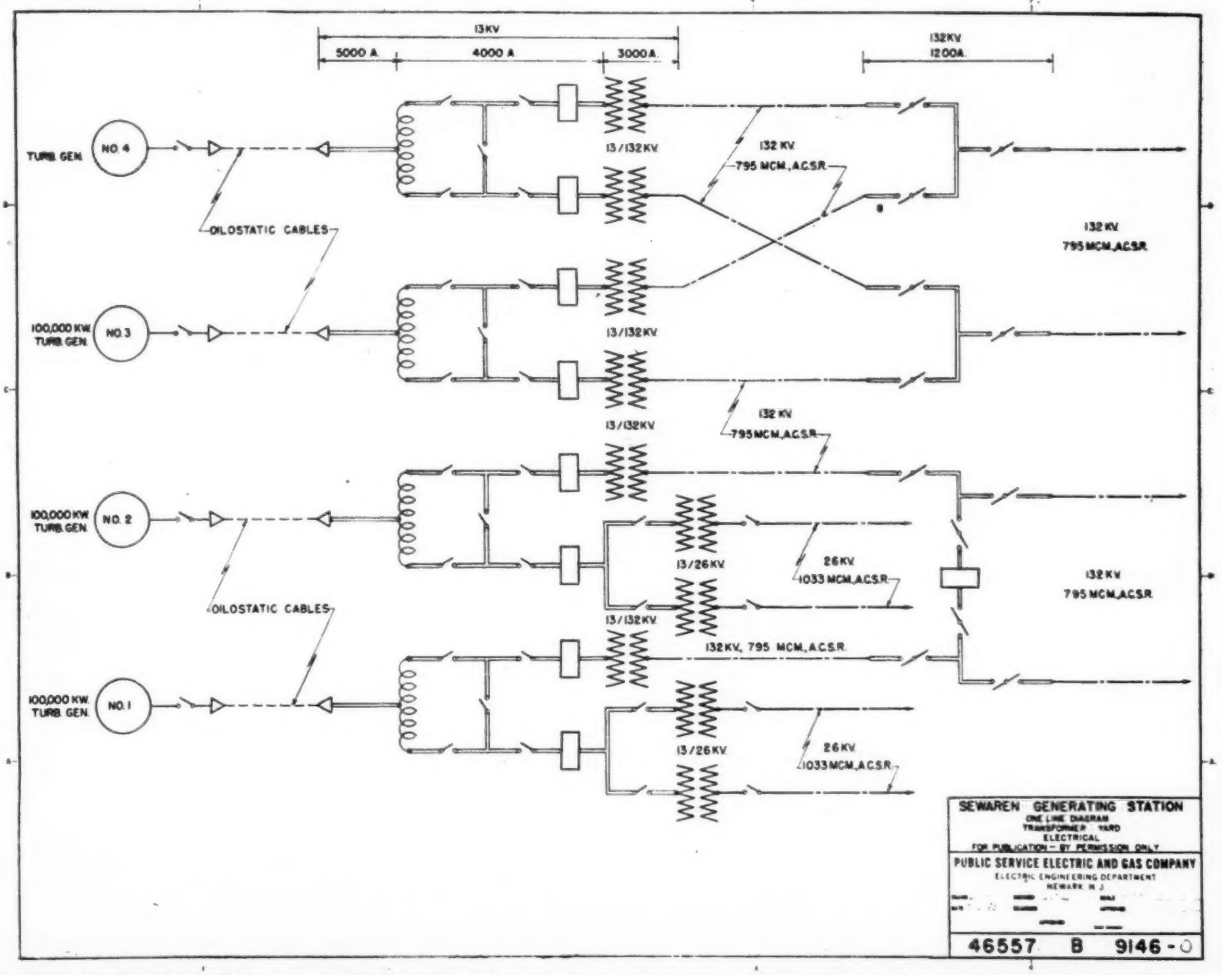


Fig. 1—One-Line Diagram of Transformer Yard, Sewaren Generating Station, Public Service Electric & Gas Corp., Newark, N. J.

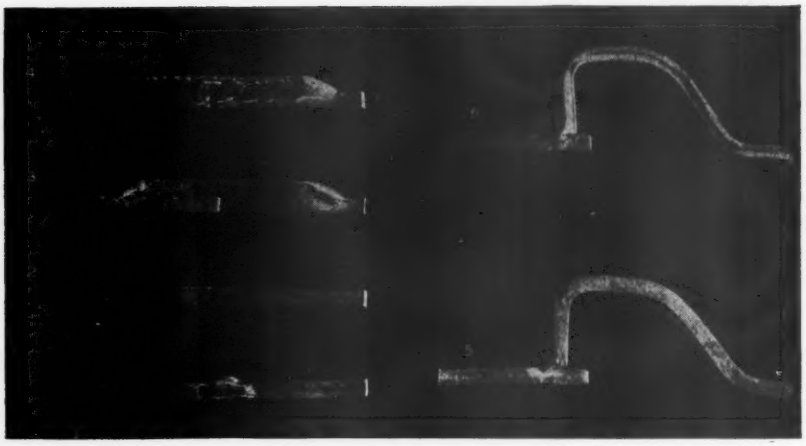


Fig. 2—Aluminum Test Welds

1928 an installation of thin-walled aluminum tubular bus with bolted connections was installed at Roseland Switching Station in order to obtain longer spans on a 220,000-volt ground supported bus. At that time the cost of the installation was equivalent to copper. The twenty years experience at this location has been most satisfactory with practically no trouble on the bolted aluminum connections. The only failures have occured at points where stranded aluminum cable was clamped in copper terminal lugs at a point where the incoming lines attach to metering transformers.

When the study of aluminum for the Sewaren bus was first started the items which attracted the most attention were—

1. Adequate cross-section of bus.
2. Method of making aluminum-to-aluminum connections.
3. Method of making aluminum-to-copper connections (at all disconnecting switches, reactors, oil circuit breakers, transformers, etc.).
4. Cost of bus in place including all material and field labor.

To determine a satisfactory cross-section for both current carrying capacity and for strength under short circuit conditions various shapes were considered. Since a maximum conductivity with a yield strength of 13,000 pounds per square inch was desired, commercially pure aluminum (2S) having a conductivity of approximately 58 per cent that of copper was selected.

The spans for supporting the bus were determined more by the arrangement of the larger electrical equipment than by the bus itself. The longest span was approximately 16 ft while the bus spacing varied between 3 ft 6 in. and 5 ft according to location.

At the start of the preliminary design work, it was decided to use Heliarc welding at all joints except where removable jumpers were needed. This type of welding is distinctly different from other methods of arc welding. Here the arc is drawn between the work and a tungsten electrode while the weld metal is a rod of pure material without any highly corrosive flux coating which must be removed after the weld is completed. The electrode, the weld metal, the arc and the work in the immediate area of the weld are all protected from the oxygen and nitrogen in the air by a sheath of inert gas such as helium or argon. Cooling water is circulated through the torch during operation. Regular a-c welding equipment to which a high-frequency stabilizer has been added is used.

Test Welds

A number of types of test welds were made as shown in Fig. 2 and the resistances measured across the different joints. The test welds were made to simulate butt, splice, and tee joints and with both single and double beads. All connections were designed to carry the entire current through the welds alone due to the immediate oxidation of exposed aluminum surfaces. The original test samples were made using a 2S rod and later similar tests were run on welds made with a 43S alloy rod. Since there was no appreciable difference in the results, the latter was used in the field as it is an easier material with which to weld. The results of these laboratory tests (Tables I and II) show that in most cases there was less drop across the welds than in the base material, due to a greater cross-section in the weld itself.

In order to eliminate any strain on bushings and bus supports, all connections from the 13-kv bus to equipment are made through flexible copper braids. This was one of the factors which helped to determine the cross-section of the bus used, as no clamp blocks were required where there were flat surfaces for bolting the braid pads.

TABLE I

RESISTANCE OF WELDED TEST BARS
(SHOWN IN FIG. 2)

Weld No.	Sample No.	Type of Weld	Resistance in Microhms: Welded Section	Plain Bar
1	1	Butt weld-two sides	82.63	83.15
1	2	" " " "	89.33	90.63
2	3	" " one "	84.64	83.99
2	4	" " " "	85.57	84.70
3	5	Splice-Welded ends only	84.53	83.12
3	6	" " " "	87.25	85.32
4	7	" " " " & sides	71.29	85.31
4	8	" " " " "	73.97	91.55
5	9	Tee-Single bead	87.95	87.68
5	10	" " "	87.26	91.21
6	11	" Double "	85.16	90.00
6	12	" " "	84.34	85.73

Bars were approximately 1/4 in. thick by 1/2 in. wide.
Readings taken on sample 25 centimeters in length.
Welds made with 1/8 in. rods of 2S aluminum.
Tests run at 20 C.

Table I, At Left, Refers by Number to the Numbered Test Welds on 2S Aluminum Rods Shown in Fig. 2, Above Left

TABLE II

Weld No.	Type of Weld	Resistance in Microhms: Welded Section	Plain Bar
1	Butt weld-two sides	34.35	34.81
2	Splice-Welded ends only	38.09	35.41
3	Tee-Single bead	33.21	34.53

Bars were approximately 3/8 in. thick by 1/2 in. wide.
Readings taken on sample 15 centimeters in length.
Welds made with 43S rod, 5% silicon.
Tests run at 20 C.

Table II—Resistance Tests of Welds Using 43S Alloy Rod

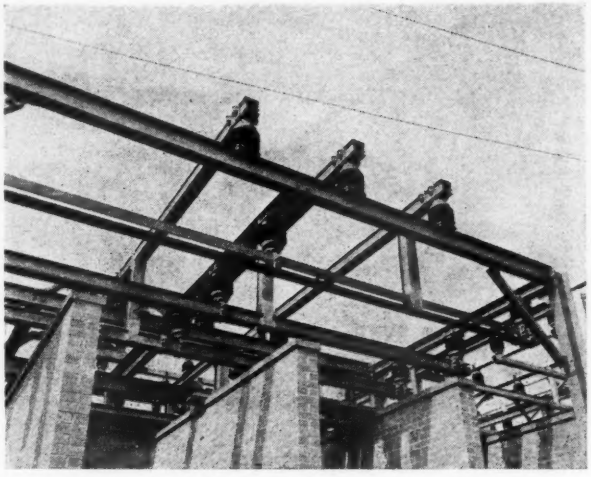


Fig. 3—13-Kv, 5000-Amp Welded Aluminum Bus Consisting of 6 by 4 In. Angles

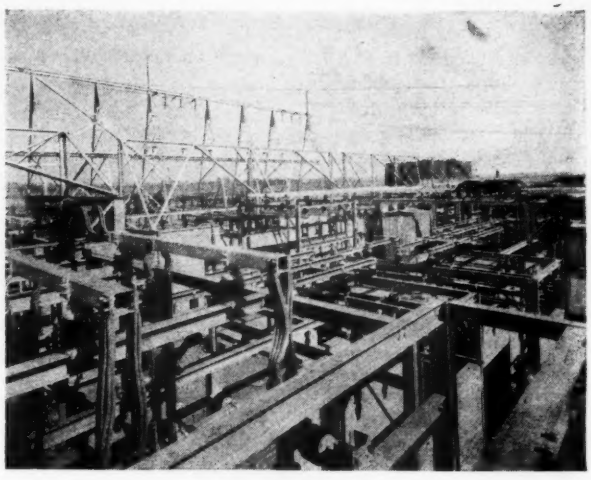


Fig. 4—13-Kv, 4000-Amp Aluminum Bus With Short Circuiting Disconnects and Copper Flexible Braids

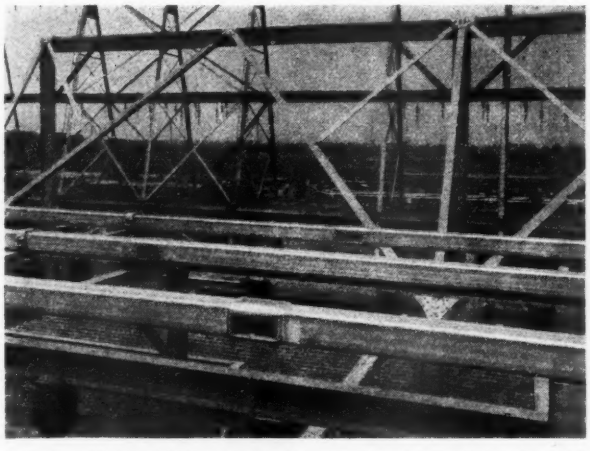


Fig. 5—13-Kv, 4000-Amp Welded Aluminum Bus Showing End Connection on 6 by 6 In. Square Tubing

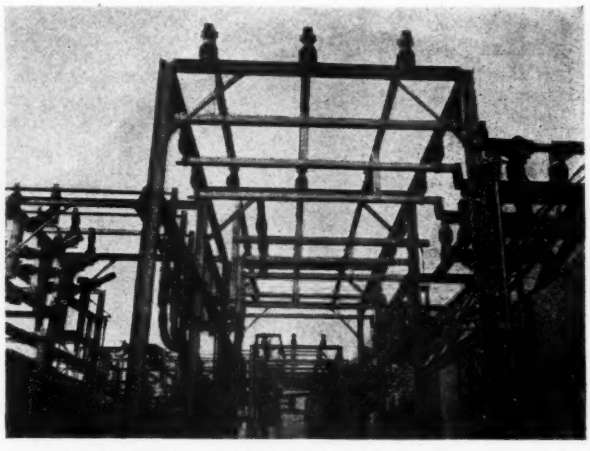


Fig. 6—13-Kv, 3000-Amp Welded Aluminum Bus Consisting of 5 by 5 by ⅜ In. Square Tubing

On the 5,000-amp bus two 6 in. by 4 in. by 7/16 in. angles were used forming a square with the 6 in. leg horizontal and having a total cross-section of 8.36 sq in. (see Fig. 3). This gave the greater strength in the direction which was required for short circuit stress. Angles of this size are available in lengths up to 80 ft so that there were no end splices necessary. A top fitting for the bus supports was developed which was simple and yet permitted either a tight or sliding clamp. By using two top halves of these clamps a suitable intermediate fitting was available as a spacer between bus supports. These were placed at about 3 ft intervals along the bus. The clamps were made of 195T4 alloy (16,000 pounds per sq in. yield and 32,000 pounds per sq in. ultimate) and were attached to the galvanized cap of the bus support by hot-dipped galvanized bolts. It was found by test after manufacture that the rolled angles developed a yield of 15,000 - 16,000 pounds per sq in., which was considerably higher that the 13,000 pounds per sq in. used in design so there is a much higher safety factor than originally contemplated. Although there may be some current flow across the bus clamps and spacers to equalize the current in the two angles of the same phase, the bus runs are all relatively short and the end and tee connections were so designed to give adequate current flow to both angles by means of splice plates.

The 4,000-amp, 13-kv bus is a 6 in. by 6 in. by ⅜ in. square tube having 8.19 sq in. cross-section (see Fig. 4). An aluminum bus clamp was also used on this bus. The tee connections were made with a 4½ in. by 10 in. splice plate on each side giving approximately 70 in. of fillet weld per joint. These plates were not considered necessary for strength in the joint but were added purely to give better current distribution through the welds to the square tubing. End connections on this bus had 4½ in. by 10 in. by ⅜ in. plates on all four sides which gave nearly 120 in. of weld for carrying the current (see Fig. 5).

A heat run on this size tubing was made in the laboratory and the results showed a 30.5-deg C rise at 5000 amperes and a 20-deg C rise at 4000 amperes. This bus is rated at 4170 amperes. The welds ran slightly cooler than the bus itself.

The 3,000-amp bus consisted of 5 in. by 5 in. by ⅜ in. square tubing (see Fig. 6). This section was selected over a 6 in. by 6 in. tube having a thinner wall of similar cross-section area to avoid any possible error in field erection. The cross-section area for this bus is 6.68 sq in.

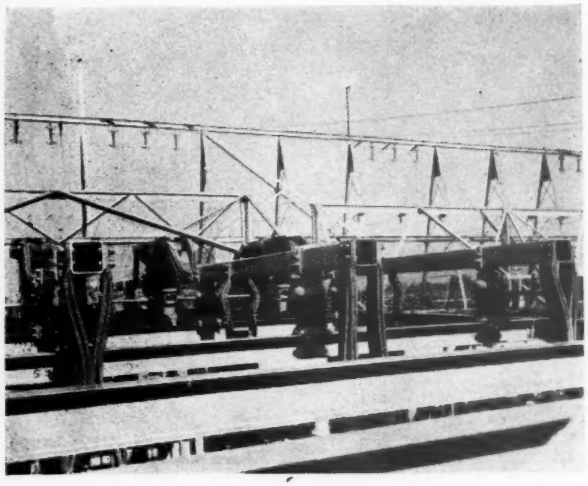


Fig. 7—Method of Making Connection to Square Aluminum Tubing by Copper Flexible Braids

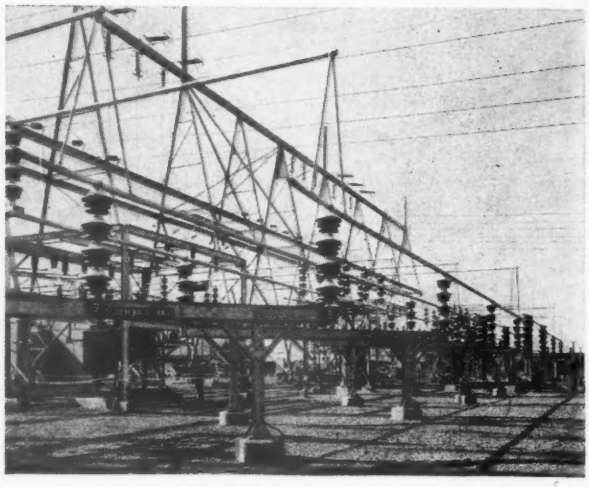


Fig. 8—132-Kv Bus Consisting of 4-In. O. D. Aluminum Tubing With Welded Connections

Fig. 9—Welding on 4-In. O. D. Aluminum Tubing

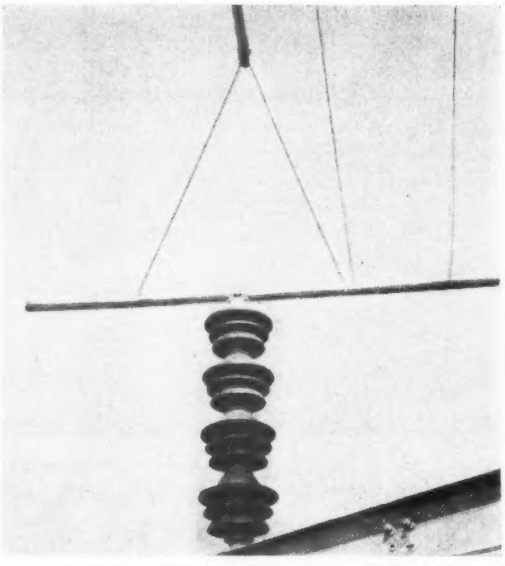


Fig. 10—Welded Tap on 132-Kv, 4-In. O. D. Aluminum Tubing

All end and tee joints are similar to those for the larger tube.

All copper pads of the flexible braid connectors (see Fig. 7) are furnished by the manufacturer with an aluminum plate ⅛ in. thick sweated on the side to be bolted to the bus. This plate is readily fastened by wire brushing the aluminum surface under a coating of Alcoa No. 802 solder and the application of heat by means of a blow torch.

Wherever bolted connections are made between tinned copper or aluminum surfaces, hot-dipped galvanized bolts coated with a No-ox-id are used. All aluminum clamps are furnished with high strength aluminum bolts of 24ST alloy (68,000 pounds per sq in. ultimate tensile strength), having an Anodized finish. Galvanized Palnuts provide the locking device.

No expansion connections have been used other than the flexible braids as there are no extremely long bus runs and each section has only one fixed bus clamp, all others having a sliding fit.

The 132-kv bus (see Fig. 8) was of entirely different construction due to electrical and physical requirements. This bus need carry only 1,200 amp and must have a span of 33 ft between bus supports to match the unit bay construction. It is therefore a structural design problem rather than an electrical one.

A 4 in. outside diameter ⅛ in. wall aluminum tube was selected having a 1.521 sq in. cross-section area. This bus gives approximately 1½ inch deflection under one inch of ice loading. A 12 in. section of the same 4 in. outside diameter tubing was slotted and used as an inside sleeve for making end connections (see Fig. 9). This sleeve had a small tapped hole in the center in which a machine screw was placed during assembly. This screw not only centered the sleeve in the joint but also acted as a spacer to keep the ends of the bus apart. A single welding bead placed in the groove not only butt welded the ends of adjacent sections of tubing but also fastened the sleeve in place. The machine screw was removed after the weld was started. The

(*Continued on page* 424)

Importance of Newly Developed Methods to Process and Store Farm Crops

By Arthur W. Turner

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United States Department of Agriculture

An address presented before the National Farm Electrification Conference, Chicago, Ill., November 18, 1948

THE old idea that the world will beat a footpath to the door of the man who builds a better mousetrap than his neighbor is as true today as when it was first advanced by Ralph Waldo Emerson. Perhaps some will wonder immediately what mouse traps have to do with farm electrification and particularly with new methods of processing and storing farm crops. Let me hasten therefore to explain, for the analogy is not too far fetched, that even Emerson did not expect his statement to be taken literally. What he was trying to put across, of course, was that the world will openly acclaim and quickly accept new ideas that are sound and practical.

Better Agricultural Mousetraps

Most of us in this group are either research workers, electrical manufacturers, power distributors, farmers, editors, or educators. In a way all of us are inventors, builders, salesmen, or users of better mousetraps. Figuratively speaking, progress in agriculture, in which all of us are directly interested, has been marked by certain outstanding milestones that stand as monuments to men who dared to build better mousetraps than any the world had previously known. Some of these have been in fields of plant development and soil improvement. Some have been in engineering, in which I am best qualified to speak. They include such developments as the reaper, the plow, the threshing machine, the tractor, the combine harvester, electric lamps, the farm water system. The latter two are the most commonly accepted applications of electricity in agricultural production.

During the war, engineers developed many important devices essential to victory that made use of principles of electronics. The word became a sort of magic term to the general public. Now engineers are seriously studying possibilities of peacetime applications.

Only recently a letter came to the USDA from a group of pickle manufacturers asking if help could be given on an electronic method of grading cucumbers. They were familiar with machines devised for grading such farm products as beans, which use a photoelectric cell to eject any off-color beans and enable distributors to offer consumers beans of more uniform grade. The pickle manufacturers already have spent several thousand dollars to determine whether the same general method can be used for their product, and are convinced it can be.

Electricity is already being used in many ways to process crops both on and off the farm. A month ago, for example, I visited a big cotton gin in the High Plains area of Texas. The most noticeable feature of the plant was the battery of infrared lamps installed in the feeding mechanism of every gin stand. Although the cotton previously had been dried on its way to the gin by passing through a standard drier, it was being given the additional exposure to infrared radiation before entering the gin. The ginner explained that he wasn't sure that the infrared lamps helped much so far as additional drying was concerned, but he was certain they exerted a sort of ironing action on the individual fibers that improved the operating efficiency of his gin.

More Electrified Farms

Our interest in electric energy for processing farm products lies especially in applications that can be used on the farm or in nearby rural industries processing products still owned and controlled by the farmer. The latest figures on electrified farms as of last July 1 showed that more than four million, or almost 69 per cent, of nearly six million farms in this country now receive central station electric service. This development has given farmers the means to do for themselves many of the processing operations that now generally are done after the products leave the farm or are shipped from the community in which they are produced.

In all these processing operations the most convenient and suitable power source is electricity. Further development could lead not only to an increase in the power distribution on rural lines but also to a wide market in new types of electrically operated equipment of many kinds.

Commodity Conditioning on the Farm

One of the new milestones in agriculture now coming into view is in commodity conditioning on the farm. I refer particularly to the use of equipment that many prefer to call a "crop drier." Many of us in agricultural engineering research are convinced that in the short period of 5 or 6 years a crop conditioning unit will be as common on many farms as corn pickers and combines, and perhaps even as the plow, are now. Some may be startled by that statement, but I want to emphasize it. Conditioning of farm products, such as grain and hay crops, has been proved by research to be both practical and desirable. Units to do the job properly should have been developed years ago. They are now coming along rapidly, thanks to the automatic and dependable characteristics of electricity.

Agriculture in this country has never been and never will be static. It is because of the dynamic nature of the industry that our production has reached the highest levels per worker of any country in the world. Great changes are still ahead of us, as a result of new developments in technology and engineering, and foremost among them will

be those affecting conditioning, processing, and marketing of farm commodities. Farm mechanization, as applied to production in field operations, has already made great progress. The big new challenge is in so caring for the products raised that they will be of maximum benefit in human use.

The question arises here as to just how much of our farm production is lost after harvest, or from the start of crop recovering or harvesting operations. Few figures are available. It has been estimated conservatively, however, that 10 per cent of the total of all grain crops each year is destroyed or seriously damaged at the farm level alone by rodents, weevils, mold, and fire. In a good crop year, such as 1948, these losses may run well over 600 million bushels. That is a staggering total, for in 1947 the European demand for grains from this country was only 578 million bushels. That 10 per cent loss would break any other industry and is no doubt splattering red ink on many farm account ledgers.

Other losses also occur, some not so visible as those resulting from action by rodents, weevils, mold, and fire. Losses in nutrient values may show up only after chemical analysis or actual feeding trials. Take hay, for example. Tests have shown that losses of carotene between cutting of the green forage and feeding of the cured hay may be as high as 90 per cent while protein losses may commonly run 50 per cent. In total, it has been estimated that annually these protein losses between harvesting the green forage and feeding of the hay are enough to feed 750,000 dairy cows for six months.

Processing For All Crops

The problems of conditioning and processing are not limited as to crops, but cut across the entire field of agriculture and almost all crops. Two years ago the first allocation of funds under the Research and Marketing Act was for research and development of equipment and procedures for drying or conditioning corn on the farm. The work that has been and is being done under that project is familiar to many in this group. Since it was started, the conditioning problem with respect to farm commodities, has become clearer. Indicative of the overall picture is the fact that the RMA commodity committees for a number of crops have put conditioning investigations high in priority of research needed in the immediate future. Within this past year our engineering work in this field has been expanded to include a project on rice, additional work on tobacco and cotton, and investigations with respect to handling and storage of apples.

Conditioning in the Field

Combining and other modern methods of machine harvesting complicate the problems of conditioning and storage. This is true for cotton and cottonseed, corn, rice, soybeans, peanuts and tung nuts, hay, legume seeds, wheat, and other crops. The products come from the fields with higher moisture content and in many cases less mature than with other harvesting methods and equipment. The time required in farm storage previous to processing or marketing is often lengthened. The result has been an increasing need for some system of conditioning that will eliminate most of the risks of damage or losses in storage. In some cases lack of conditioning equipment has been a roadblock to further mechanization of field operations in producing the crop—notably with field shelling of corn, picking of peanuts from the green vines at digging time, and field hulling of tung nuts. Other examples could be listed.

Improvements in crop conditioning are essential in an advancing agriculture and their development is an engineering responsibility. Growth in our population will call for storage of larger quantities of high-quality commodities for longer periods. Industries processing food commodities are increasingly demanding products of known and uniform quality. Improved conditioning facilities are essential to speed crop harvesting. Importance of the problem was never more apparent than in 1947 when it appeared farmers would have an immense quantity of "soft" or immature corn at harvest time.

During the Soft Corn conference in July of 1947 a searing indictment was made against the antiquated methods used in corn storage, particularly with reference to cribs. It was stated then that despite all the engineering advancements that had been made in production, farmers still had to rely on the wind blowing through holes in the sides of a bin to dry their corn. Regardless of the growing season or moisture content of the corn, drying was still being done just as during the time of early settlement—dependent entirely on the weather, which is unpredictable. That is still generally true, although adoption of artificial conditioning has been rapid in the last two years.

Why not field-shell corn? The only reason this has not been done is that facilities have not been available for conditioning the grain after harvest. Tests have shown that on the average 60 per cent of the moisture in ear corn is in the cob. Isn't it advisable to leave the cobs in the field and out of the drying and storage problem? This makes good sense to me. In cooperation with State engineers and agronomists our investigators are now making studies of methods and procedures to condition field-shelled corn in tight bins.

Crop conditioning now is being done mainly with driers, and they are doing a good job in eliminating or minimizing weather hazards. It seems possible that eventually the market for these units may be as high as 5,000,000.

So far, however, research has not developed all the answers with respect to requirements in their operation. Factors that must be considered include rapidity with which moisture can be removed so as not to affect germination, milling qualities, and feeding values. Caution also is necessary to avoid fires, and for this reason fire underwriters have been asked to work out standards to guide development of drier equipment.

Engineers studying conditioning problems are aiming at development of a universal unit—one conditioner that can be used for a wide range of commodities. The search is for a method of conditioning a commodity on its way into storage or as it is harvested.

Improved Storage Structures

At present many grain bins and all hay mows are essentially conditioning chambers. They provide a place for storage, but are not always well suited for conditioning. It seems certain that improvements can be made. As better procedures for conditioning are developed it may be necessary to design new storage structures for the job and in some cases entirely new systems will be evolved that will eliminate entirely the present types of conditioning and storage buildings.

A great deal of fundamental research still needs to be done on this problem of crop conditioning. Engineers need to know what causes moisture to move from the center of a seed, leaf, or fiber to the outside where it can be absorbed

or evaporated. Then ways can be developed to expedite this moisture movement and a more scientific method evolved for doing the important job of conditioning the crop for storage.

This conditioning and processing is one of the most promising fields for immediate widespread new applications of electricity on the farm. The job may in some cases require the use of electric energy as light, heat, or other forms of radiation. In many cases it will require careful regulation, which can best be done with electric controls. It will most certainly be done with electric power.

Even in processes where the application of heat is necessary, conditioning often involves much more than drying or evaporation of moisture. With enough air and heat any product eventually can be dried. The problem is to do the job in such a way that the product retains the quality characteristics consumers want and will pay high prices to get. That is why careful study of the product, its storage requirements, and quality factors is necessary before it is possible to develop any type of conditioning equipment on a scientific basis. Engineers need to know the biological nature of a product and what can be expected to happen to it in every step of conditioning, processing, and storage.

The complexity of some of these problems is well illustrated in the flue-curing of tobacco in the Carolinas, Virginia, and Georgia. The process involves three distinct steps—yellowing of the tobacco, killing and drying the leaf, and killing and drying the stem. It has been in use with little variation either as to procedure or equipment for more than 150 years.

Fuel Efficiency Studies

At Oxford, N. C., engineering studies have been under way in cooperation with the North Carolina station for several years. The project is a good example of a well-developed plan of engineering research. Under Dr. O. A. Brown the procedure has included application of common sense and good engineering for immediate improvement in the standard methods, particularly in the efficiency of fuel consumption. A long-time study also is being made, however, as a basis of further improvements and perhaps of changes in the entire curing procedure. This has involved fundamental studies of changes that take place in the tobacco as it is cured and why and how these changes occur.

During the first year of the curing studies the amount of coal used in curing a barn of tobacco was reduced from 2400 to about 800 pounds, and further improvements have since been made. More recently the fundamental studies have begun to pay off. Last summer it was possible to set up a system of electric controls and cure out a barn of tobacco automatically and without an attendant. The quality of the cured tobacco was better than normally obtained, with the bright lemon color that the market desires.

Continuous Process Curing

Automatic curing is far from perfected, but the first step toward a new continuous process to replace the present "batch" method was taken in the trials last summer. The idea is sound. When fully developed it should enable producers to prime their tobacco day by day according to color or maturity of the leaves in the field, to put a uniform product into the cure each day, and to obtain a uniform, high-quality finished product. It will enable the grower to harvest his tobacco with his own family labor rather than with the large crews now used, and will eliminate the tedious job of tending furnace that now sometimes involves 100 hours at a stretch.

Crop conditioning and processing is no small-scale "peanut" operation. As a matter of fact, even with such crops as peanuts and tobacco, it is big business with tremendous possibilities for farm electrification and for equipment manufacturers. When Dr. Brown was in Washington last week he stated that even now, with their out-moded structures and equipment, tobacco growers have a total investment greater than that of United States Steel. Investments in equipment for other crops where the need for conditioning is equally as great may be even higher.

Conditioning will not always be done by heating. In some cases cooling or refrigeration will be required. Successful storage of sugar beets, for example, is dependent on low temperatures, and losses of sugar from heating may average a pound a day per ton of beets. In a 100,000-ton pile of beets that soon adds up into real money. Other commodities, like fruits and potatoes, also require cooling or refrigeration in storage.

Research in farm refrigeration is still in its infancy. An expanded program could provide growers with enlarged markets for perishables and the consumer with larger quantities of high-quality fruits, vegetables, and dairy products. The operation of refrigeration equipment would, of course, call for use of electric energy.

Other types of conditioning also are being suggested as research moves further into the applications of electric energy. High-frequency radiation so far has had little opportunity to demonstrate its usefulness in agriculture. It has been suggested, however, that by this means milk can be pasteurized and homogenized in one operation, enzymatic action in grains controlled, and the bacteria in eggs that transmit certain poultry diseases destroyed. The possibilities in seed selection for viability by use of electricity as well as treatment for growth stimulation are another fertile field for exploration.

In the USDA research program some interesting observations are being made on bactericidal lamps in poultry houses for control of air-borne diseases and stimulation of egg production. Other uses of heat being investigated are for reducing the mortality of bees, chicks, lambs, and pigs. Pigs and other animals can tell us much about utilization of electricity. During the last two summers at Washington with temperatures in the high 80's some of us were amazed to see how litters of young pigs in the farrowing pens made use of the heat lamps.

Research in farm electrification is now increasing, but not as rapidly as its potentialities seem to justify. The USDA work is in nearly all cases cooperative with Departments of Agricultural Engineering in the states. The number of our electrification projects has more than doubled in the last two years. In addition many new projects have been undertaken independently by the states. On the basis of present prospects I am sure that electricity will really have its day in agriculture. In the field of commodity conditioning and processing, especially, that day is not far off.

The All-Electric Kitchen Program

(*Continued from page* 398)

Use them to beat your competition and get your share of the potential added annual revenue of over $2\frac{1}{3}$ billion a year. That will happen when a good share of your customers can say with pride, "Of Course—It's Electric."

Specifications and Statistical Sampling

(*Continued from page* 404)

for range by less than 6 or 7 sub-groups of 5 each, say 30 to 35 insulators. However, from his experience with insulators he should have known the order of range to be expected and could have assumed this figure without serious error and without the necessity of testing a number of sub-groups.

Sampling is the heart and soul of almost all specifications and we should distinguish clearly between two very different methods of sampling:

1. Sampling by attributes (distinguishing only between good and bad).
2. Sampling by variables (measuring on a continuous scale).

To sample effectively by attributes usually takes much larger samples than to sample by variables. In fact, for destructive tests the necessary sample is prohibitive. If a specification says "minimum" or "maximum" we are, in effect, electing to sample by attributes since we have an interest in only one value, the smallest or largest, of the tested sample. That is why such "min-max" clauses should be avoided if at all possible. They often relate to characteristics that are vital and call for destructive tests. Because the test is destructive the sample is almost always woefully inadequate and it is easy to fall into the error of relying implicitly on a set of test values that are, as a matter of fact, very unreliable.

It follows then that if a tested characteristic has wide dispersion, a small sample cannot be relied upon to tell the truth about either the average of the batch or its minimum unit. All we can ask of the small sample is that it occupy with some reasonable probability a position within the envelope of the whole batch dispersion pattern; and that it have a range not inconsistent with the width of this dispersion pattern. We assume that both of these requirements are satisfied if the point falls within the control limits for averages and the control limits for ranges shown on a product control chart. These limits are drawn wide enough for customer use to rule out all except the most improbable chances for it. They are drawn narrow enough for factory use to alert the organization to the first indication of a loss of factory control in the manufacturing operation.

The Next Twenty-five Years In Accident Prevention

(*Continued from page* 409)

assembly line jobs, I am sure that in our industries we must give more attention to how and where we work our men.

This is something to which we must give a great deal of study in the future, if we are to turn our accident curves down. Not only must our foremen study their men, but our superintendents must study the foremen to see that they too are free from neurotic tendencies which make them — and through them, their men—accident prone.

And while the superintendents are checking the foremen, who will do the checking on the superintendents? We must be sure that they too are schooled in safe operating methods and in human relations. They must have a full and penetrating awareness of their responsibilities. It ought to be easier for them to become safety conscious than it is for our managers and presidents. They are closer to the accidents and to the men who are injured, but they too should receive from their supervisors both guidance and assistance.

Safety directors should not be afraid to give advice to their superiors right up to top management, even though it is not popular. Their chief executives are no doubt *interested* in safety, or think they are. It is the Safety Director's job to show the boss how he can turn that *interest* into effective *work* in preventing accidents. Officials in line of authority must learn to accept their full responsibility for accidents, and the higher the official, the greater the responsibility.

I think the reason so few top executives get really stirred up about it is due to the fact that they seldom, if ever, get to the scene of an accident and actually see what happens to a man who is killed or permanently injured because of improper operating methods, or because somebody blundered. If the chief executive attended the funerals as the Safety Director does, he might sometimes wonder what *he* might have done to have saved those lives.

This program is one for all hands to work on. If we put in effect these ideas we have been considering, not in a comparatively few companies as at present, but on a nation-wide basis, I feel sure that we shall soon see a marked drop in our accident curves. The trend should then be permanently *down*.

Third National Farm Electrification Conference

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recommended set-ups for major farm electrical equipment are particularly valuable.

Eugene Hansen, National Student Secretary of the Future Farmers of America, told the Conference of the interest of farm youth in electrical equipment. Young farmers, he said, are determined to use the most modern farming methods, and electricity has played a large part in encouraging them to make farming their careers.

"An efficient American agriculture is one of the greatest factors working for world peace," the Conference was told by Graham Patterson, publisher of *Farm Journal* magazine, at its final luncheon meeting. Improved agricultural methods and implements allow only 16 per cent of our population, engaged in agriculture, to produce food and fibres for the entire nation, he explained, and "this means that 84 per cent of our people can devote their time to the industrial production that gives America the highest standard of living the world has ever known, and during the war astounded the world with its incredibly large production of guns, tanks, ships and other weapons of war."

Credit for agricultural efficiency, he said, "goes in part to American ingenuity and initiative, and to free American industry in providing better tools for the farmer—the time and labor-saving equipment which enables the American farmer to produce more with less effort."

PERSONALS

ISAAC FOGG, President of Atlas Powder Co., and ADOLPH A. RYDGREN, President of Continental American Life Insurance Co., have been elected to the board of directors of the Delaware Power & Light Co. The newly elected members fill the vacancies caused by the deaths of THOMAS W. WILSON and ELWYN EVANS.

Born in Pennsville, New Jersey, Mr. Fogg was educated in the public schools and started his business career as private secretary to Prof. Edward J. Houston, co-inventor of the Thompson-Houston arc light, one of the important developments in the early stages of the electric lighting industry. He remained with Prof. Houston until 1906 when he accepted a position with the Goshen Iron Works. In 1912 he became connected with the Atlas Powder Co. and from the beginning of his association with that company, Mr. Fogg rose steadily through the ranks, being made Assistant Secretary and Treasurer in 1917. He was elected secretary-treasurer and director of the company in 1927, vice president in 1931 and President in 1945.

Mr. Rydgren is also a native of New Jersey having been born in Newark, receiving his education in that city and in Brooklyn, N. Y. Embarking upon his business career, he started in the actuarial department of the New York Life Insurance Co. and while there, earned his degree F.A.S. (Fellow of the Actuarial Society of America). He rose to prominence as an actuary known throughout the insurance world.

During World War I, his business career was interrupted while he served in the U. S. Army. Upon return to civilian pursuits, he was appointed Actuary of the Cleveland (Ohio) Life Insurance Co. but resigned this position in 1921 to become associated in the same capacity with the Continental American Life Insurance Company of Wilmington. Two years later, Mr. Rydgren was elected vice president of the latter company and in 1932 was made President.

DOUGLAS B. MCGREGOR has been appointed vice president and general manager of the Arizona Edison Co., Inc., Phoenix. FRANCIS W. SMITH has been named treasurer to fill the vacancy created by Mr. McGregor's promotion.

Widely known in utility circles, Mr. McGregor has been with Arizona Edison for 18 years. He became chief clerk of the company's general office in Phoenix in 1931 and advanced to the position of assistant secretary. He soon was made treasurer of the company and in 1942 was appointed a vice president.

Mr. Smith was assistant treasurer of the company before his recent promotion. He went to Arizona from Southern Union Gas Co., Dallas, Tex., where he served as director, vice president, and treasurer. Until going to Arizona this spring, Mr. Smith was engaged in handling financial and accounting matters for the Texas utility.

D. BRUCE MANSFIELD of Greentown, Ohio, partner in the law firm of Amerman, Mills, Mills, Jones & Mansfield of Canton, Ohio, has been named general counsel of Ohio Edison Co.

Mr. Mansfield, 38, is a native of Hamilton, Ohio, but has lived in Stark County most of his life. He completed his elementary schooling at McKinley High School in Canton and graduated from Kenyon College in 1930. He received a degree of bachelor of laws from Duke University in 1933 and the degree of doctor of jurisprudence from Yale Law School in 1935. From 1934-1938 he taught finance and corporation law at Temple University.

From 1938 to 1940 Mr. Mansfield was a senior attorney with the public utilities division of the Securities and Exchange Commission. The following year he taught law at the University of California. In 1941 he returned to Canton and has been associated with his present firm for the past seven years.

ALFRED P. RAMSEY, who has been assistant general counsel for the Consolidated Gas Electric Light and Power Co. of Baltimore since 1927, has been appointed general counsel of the utility, President Wm. Schmidt, Jr., has announced.

Mr. Ramsey's appointment fills the vacancy created by the death of EDWIN M. STURTEVANT who was general counsel since 1927.

Mr. Ramsey is a graduate of Thiel College and obtained his legal education at the University of Minnesota and Yale University.

Before entering the employ of the local utility in 1924, he was a member of the legal staff of the Minneapolis, St. Paul & Sault Ste. Marie Railway Co.

JAMES M. STUART has been appointed associate general manager and a director of the Dayton Power & Light Co., Ohio. In this capacity, Mr. Stuart will continue in charge of electric operations and several other divisions of the company will be added to his responsibilities. He will continue as vice president, to which position he was elected in 1947.

The highlights of his advancement in the company are: assistant supervisor, underground department, 1930; supervisor, same department, 1937; manager of the electric division, 1942; manager and vice president of electric operations, 1947; director and vice president in 1948 of six Greenville, Ohio, subsidiary electrical properties acquired by Dayton Power & Light Co.

RICHARD B. PARSONS has been appointed manager of the Quincy (Mass.) Electric Light and Power Co. Obtaining his early experience with the Narragansett Electric Lighting Co., Providence, R. I., he was transferred to Boston, where he was with the New England Power Engineering & Service Co. and for a time was western district engineer with headquarters at Northampton, Mass. From 1934 to 1942 he was executive assistant at Boston.

Since 1942 Mr. Parsons has been vice president and manager of the Weymouth (Mass.) Light & Power Co. and continues in the former capacity.

FRED H. RENNERT has been appointed superintendent of the Keokuk power plant of the Union Electric Co. of Missouri. He succeeds PHILLIP M. CHAMBERLAIN, who retired after completing nearly 33 years' continuous service with the company. Mr. Rennert was formerly mechanical superintendent at the Keokuk plant.

HENRY H. STARTZMAN has been appointed assistant chief engineer of the Potomac Edison Co., Hagerstown, Md. The position of manager of the power sales and engineering department vacated by Mr. Startzman will be filled by L. V. MILTON. Mr. Milton has been industrial representative of the power sales and engineering department.

Mr. Startzman has been with Potomac Edison since 1928, when he joined

the company in Cumberland as manager of the merchandise department. Later that year he was transferred to the industrial engineering department in Hagerstown and four years later he was appointed manager of power sales and engineering department. Prior to becoming identified with Potomac Edison in 1934, Mr. Milton was connected with Westinghouse in the testing, power sales, and central sales departments.

HARRY G. HALL, superintendent of underground lines of the Detroit Edison Co., has retired after 43 years of service. He had been superintendent of underground lines since 1930. LEMORE W. CLARK has been appointed to succeed him.

JAMES F. FAIRMAN, vice president of Consolidated Edison Co. of New York, has been elected vice president of the United Engineering Trustees, Inc., New York.

ROB ROY MACLEOD, vice president of the Buffalo Niagara Electric Corp., has been appointed chairman of the state and national affairs committee of the Buffalo Chamber of Commerce.

Welded Aluminum Bus In Outdoor Transformer Yard

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sleeve will not carry any current but was used purely for mechanical strength.

Cast aluminum caps are used on all exposed bus ends. Small holes are drilled in the bottom of the tube at the center of each span to provide for drainage.

The connections to the disconnecting switches are made by means of a cast aluminum fitting of our own design providing a pad to match the switch terminal. The tubular bus is welded to this casting. Copper plates were sweated to these castings by the same method as the aluminum plates were attached to the flexible braid copper pads.

All taps to the 132-kv bus are above and at right angles to the main run with an "A" type connection having two legs of 1¼ in. IPS aluminum at 15 degrees to the vertical (see Fig. 10). Both the single top fitting and the two bottom fittings are cast aluminum of our own design. A No. 43 alloy having a 42 per cent conductivity was used for all castings, a larger cross-section area compensating for the lower conductivity. Most of the welded joints of the bus tap were made on the ground and the fittings so shaped that the bus could be set in place before the final welds were made. Each tap connection straddles the bus support of the ground supported bus.

All welding on the job must be done by electricians and since this type of welding is relatively new and somewhat different from the standard a-c arc welding it was necessary to train several groups. A good mechanic should become familiar with the method and be able to do creditable work after about 16 hours of instruction.

Although Sewaren is in a fairly isolated location and on a large plot of ground, a radio trouble car with a broad band receiver cruised in the neighborhood and was unable to pick up any interference due to the high frequency welding. As much of the welding as possible was done with the men working on the ground in order to cut the cost of scaffolding. However, it was found necessary to erect enclosures wherever welding was done in order to prevent any air currents from interfering with the inert gas screen. At no time did the current for welding exceed 300 amperes even on the heavier wall tubing and the cast aluminum fittings.

CONVENTIONS AND MEETINGS

1948

DECEMBER

5-8 The American Society of Refrigerating Engineers, Washington, D. C.

JANUARY—1949

19-21 American Society of Civil Engineers, Annual Meeting, New York, N. Y.
20 Industrial Relations Committee, EEI, New York, N. Y.
24-25 Accident Prevention Committee, EEI, Book-Cadillac Hotel, Detroit, Mich.
Jan. 31-Feb. 4 American Institute of Electrical Engineers, Hotel Pennsylvania, New York, N. Y.

FEBRUARY

10-11 Transmission and Distribution Committee, EEI, Netherland Plaza Hotel, Cincinnati, Ohio
13-15 Industrial Relations Committee, EEI, Chicago, Ill.
14-15 Electrical Equipment Committee, EEI, New Jefferson Hotel, St. Louis, Mo.

MARCH

13-18 National Electrical Manufacturers Association, Winter Convention, Edgewater Beach Hotel, Chicago, Ill.
17-18 Industrial Relations Committee, EEI, Baltimore, Md.
24-25 Southeastern Electric Exchange, Engineering and Operation Section, General Ogelthorpe Hotel, Savannah, Ga.
29-Apr. 1 Third International Lighting Exposition and Conference, Stevens Hotel, Chicago, Ill.

APRIL

5-7 Fifteenth Annual Sales Conference, EEI, Edgewater Beach Hotel, Chicago, Ill.
11-13 National Conference of Electric and Gas Utility Accountants, Book-Cadillac Hotel, Detroit, Mich.
13-15 Southeastern Exchange, Annual Convention, Boca Raton Hotel, Boca Raton, Fla.
20-23 American Society of Civil Engineers, Oklahoma City, Okla.

MAY

1-6 National Electrical Wholesalers Association, Netherland Plaza Hotel, Cincinnati, Ohio.
2-4 Engineering Committees, EEI, Edgewater Beach Hotel, Chicago, Ill.
2-5 Chamber of Commerce of the U. S. A., Washington, D.C.
16-19 National Fire Protection Association, Fairmont Hotel, San Francisco, Calif.

JUNE

May 31-June 2 ANNUAL MEETING, EDISON ELECTRIC INSTITUTE, Atlantic City, N. J.
20-21 Public Utilities Advertising Association, Netherland Plaza Hotel, Cincinnati, Ohio
28-30 Canadian Electrical Association, Banff Springs Hotel, Banff, Canada

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